CHAPTER 6
ECONOMIC CONSIDERATIONS

SECTION I - NATIONAL ECONOMIC DEVELOPMENT (NED) PROCEDURES: GENERAL

6-1. Purpose. This chapter provides economic evaluation procedures to be used in Corps planning studies. The Water Resource Council's (WRC) Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Chapter II - National Economic Development (NED) Benefit Evaluation Procedures (March 10, 1983) have been adopted as the procedures to be used, and are presented in their entirety in this and the following eleven sections of this chapter. The original format of the Guidelines has been changed to conform to the engineering regulation format. In addition, wording has been clarified and material has been added in a limited number of cases; such changes are clearly identified in the text of this chapter. There have been no changes to the Guidelines' basic procedural guidance. **[The Corps of Engineers has implemented risk-based analysis techniques in water resource studies. While this changes some of the techniques used in analyzing flood control and other studies, the Guidelines basic procedural guidance remains unchanged. As shown here, changes in the text due to the implementation of risk-based techniques or other reasons are highlighted in bold and/or bracketed throughout the text. Since publication of the original Principles and Guidelines, policy changes have limited certain categories of benefits. Summaries of policy guidance letters or other non-technical guidance which affect benefit calculations are footnoted in the text and provided at the end of the relevant sections.]**

6-2. General Purpose and Scope.

a. The NED procedures in this chapter are for Federal administrative purposes and do not create any substantive or procedural rights in private parties.

b. This chapter provides procedures for evaluating NED effects of alternative plans.

(1) When an alternative procedure provides a more accurate estimate of a benefit, the alternative estimate may also be shown if the procedure is documented.

(2) Steps in a procedure may be abbreviated by reducing the extent of the analysis and amount of data collected where greater accuracy or detail is clearly not justified by the cost of the plan components being analyzed. The steps abbreviated and the reason for abbreviation should be documented.

(3) Proposals for additions to or changes in the procedures in this chapter may be made when an agency head determines that the new technique will improve plan formulation and evaluation. These proposals are to be submitted to the Water Resources Council for review and approval for inclusion in these procedures. Procedures that represent changes in established policy are to be referred to the Cabinet Council on Natural Resources and Environment for its consideration.

[Additional detailed support material for conducting NED evaluation may be found in An Overview Manual for Conducting National Economic Development Analysis (IWR Report 91-R-11, October 1991). Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within this IWR report.]

6-3. Conceptual Basis. Compare project NED benefits and costs at a common point in time. Present the following information:

a. Installation Period. The number of years required for installation of the plan. If staged installation is proposed over an extended period of time, the installation period is the time needed to install the first phase.

b. Installation Expenditures. The dollar expenses expected to be incurred during each year of the installation period.

c. Period of Analysis. The time horizon for project benefits, deferred installation costs, and operation, maintenance, **[repair, rehabilitation]** and replacement (OM**RR**&R) costs. Use the same period of analysis for all alternative plans. The period of analysis is the time required for implementation plus the lesser of (1) the period of time over which any alternative plan would have significant beneficial or adverse effects; or (2) a period not to exceed 100 years. Appropriate consideration should be given to environmental factors that may extend beyond the period of analysis.

[(1) The WRC's Guidelines are inconsistent in their treatment of period of analysis. The material in subparagraph c. above does not agree with that in paragraph 6-4 below. For internal Corps consistency the period of analysis will not include the implementation period. **The period of analysis for comparing costs and benefits following project implementation shall be limited to the lesser of:**

- The period of time over which any alternative plan would have significant beneficial or adverse effects; or

- A period not to exceed 50-years except for major multiple purpose reservoir projects; or

- A period not to exceed 100-years for multiple purpose reservoir projects.

(2) In cases where alternatives have different implementation periods, a common base year will be established and costs and benefits will be compounded or discounted to that base year. Projects that accrue benefits during the implementation period should refer to section 6-156 for specific guidance.]

d. Benefit Stream. The pattern of expected benefits over the period of analysis.

e. OMRR&R Costs. The expected costs over the period of analysis for operation, maintenance, **[repair, rehabilitation]** and replacement necessary to maintain the benefit stream and agreed-upon levels of mitigation of losses to fish and wildlife habitats.

f. Discount Rate. The rate established annually for use in evaluating Federal water projects.

6-4. Calculating Net NED Benefits In Average Annual Equivalent Terms. Net NED benefits of the plan are calculated in average annual equivalent terms. To perform this calculation, discount the benefit stream, deferred installation costs, and OM**RR**&R costs to the beginning of the period of analysis using the applicable project discount rate. Installation expenditures are brought forward to the end of the period of installation by charging compound interest at the project discount rate from the date the costs are incurred. Use the project discount rate to convert the present worth values to average annual equivalent terms. **[In other words, for each benefit and cost occurring after the beginning of the period of analysis, the present worth is equal to $1/(1+d)^n$ x (amount of benefit or cost), and for benefits and costs occurring prior to the beginning of the period of analysis the comparable value is equal to $(1+d)^n$ x (amount of benefit cost), where d is the discount rate and n is the number of years between the time the benefit or cost occurs and the beginning of the period of analysis.]**

6-5. Definitions. Terms used in these guidelines are defined as follows:

a. Agricultural Drainage.

(1) The rehabilitation and improvement of existing drainage systems or the construction of new drainage systems to improve the efficiency of cropland, wood-land, and grassland by lowering the water level in areas in which agricultural production has been limited by naturally high water tables, normal precipitation or normal tide action, seepage, or excess irrigation water.

(2) Drainage projects include measures for surface drainage, the removal of excess water above the surface of the ground; and subsurface drainage, the removal of excess water below the surface of the ground. Drainage projects involve watershed or subwatershed areas composed in whole or in part of lands drained or proposed to be drained. The boundaries of the water problem area may consist of artificial barriers that prevent the inflow of water originating outside the area.

b. Agricultural Flood Damage Reduction. The adjustment in land use and the structural and nonstructural measures designed to reduce hazard from floodwater, erosion, and/or sediment. Reduction of sediment on agricultural land will normally serve the single purpose of flood damage reduction. Reduction of sediment in channels or reservoirs may serve other purposes as well (i.e., navigation, water supply, power) and should be identified accordingly. To differentiate flood damage reduction from agricultural and rural drainage of flatlands, flood damage reduction is defined as any measure undertaken to reduce or prevent damages from surface water caused by abnormally high direct precipitation, stream overflow, or floods caused or aggravated by wind or tidal effects.

c. Flood. A general and temporary condition of partial or complete inundation of normally dry land from the overflow of inland or tidal waters, or the unusual and rapid accumulation or runoff of surface waters from any source.

d. Nonstructural Measure. A modification in public policy, an alteration in management practice, a regulatory change, or a modification in pricing policy that provides a complete or partial alternative for addressing water resources problems and opportunities. **[Common practice includes measures such as flood warning, floodproofing, and relocations as non-structural in flood control studies.]**

e. Separable Feature. A project element that can be implemented or constructed independently of other features and that does not depend on other features for its structural (or other) viability.

f. Urban Drainage.

(1) The adjustment in land use and storm sewer systems designed to collect runoff from rainfall or snowmelt in an urban area and convey it to natural water courses or to previously modified natural waterways. Storm sewer systems include storm drains, inlets, manholes, pipes, culverts, conduits, sewers and sewer appurtenances, onsite storage and detention basins, curbs and gutters, and other small drainage ways that remove or help to manage runoff in urban areas.

(2) Storm sewer systems are designed to solve urban storm drainage problems, which are typified by excessive accumulations of runoff in depressions, overland sheet flow resulting from rapid snowmelt or rainfall, and excessive accumulation of water in one or more components of a storm sewer system.

g. Urban Flood Damage Reduction. The adjustment in land use and the structural and nonstructural measures designed to reduce flood damages in urban areas from overflow or backwater due to major storms and snowmelt. The measures include structural and other engineering modifications to natural streams or to previously modified natural waterways. Urban flood damage reduction is accomplished by modifying temporary conditions of inundation of normally dry land from the overflow of rivers and streams or from abnormally high coastal waters due to severe storms.

h. Water Supply. The water that becomes available for consumptive and nonconsumptive uses either through increases in quantity or improvements in quality of existing supplies.

[i. Risk-based Analysis. An approach to evaluation and decision making that explicitly, and to the extent practical, analytically, incorporates considerations of risk and uncertainty. Risk-based analyses combine risk and uncertainty information of key variables so that system engineering, reliability, and economic performance can be expressed in terms of probabilities.]

SECTION II - NED BENEFIT EVALUATION PROCEDURES
MUNICIPAL and INDUSTRIAL (M&I) WATER SUPPLY

6-6. Purpose. This section provides procedures for the evaluation of NED benefits of municipal and industrial (M&I) water supply features of water resource plans. The procedures presented apply to both structural and nonstructural elements of such plans. **[Risk-analysis techniques are required in all formulation, evaluation and investment decision studies. No specific risk-based procedures have been developed for municipal and industrial water supply analysis. For studies and projects where water supply benefits constitute a substantial portion of total benefits, FOAs are expected to perform, at a minimum sensitivity analysis of key variables such as least cost alternative cost, future demand for water and future availability of water supplies.]**

6-7. Conceptual Basis.

a. The conceptual basis for evaluating the benefits from municipal and industrial water supply is society's willingness to pay for the increase in the value of goods and services attributable to the water supply. Where the price of water reflects its marginal cost, use that price to calculate willingness to pay for additional water supply. In the absence of such direct measures of marginal willingness to pay, the benefits from a water supply plan are measured instead by the resource cost of the alternative most likely to be implemented in the absence of that plan.

b. The benefits from nonstructural measures are also computed by using the cost of the most likely alternative. However, the net benefits of certain nonstructural measures that alter water use cannot be measured effectively by the alternative cost procedure for the following reasons: (1) Structural measures and many nonstructural measures (except those that alter use) result in similar plan outputs, whereas use-altering measures (e.g., revised rate structures) may change levels of output; and (2) use-altering measures may have fewer direct resource costs than measures based on higher levels of output. Because of this lack of comparability, the benefit from such use-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the benefits of use-altering nonstructural measures on the basis of willingness to pay are encouraged, although the display of such benefits is not required.

6-8. Planning Setting.

a. Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of the proposed water supply plan, including any known changes in law or public policy. Several specific elements are included in the without project condition.

(1) Existing water supplies. Existing water supplies are included in the without project condition. Make adjustments to account for anticipated changes in water supply availability because of the age of facilities or changed environmental requirements.

(2) Institutional arrangements. Existing and expected future water systems and water management contracts and operating criteria are considered part of the without project condition unless revision of these systems, contracts, or criteria is one of the alternative plans being studied.

(3) Additional water supplies. The without project condition includes water supplies that are under construction or authorized and likely to be constructed during the forecast period.

(4) Probability of water supply. Include calculation and specification of the probability of deliver for each source of water supply in the analysis.

(5) Water quality. Water use is based on both the quantity and the quality of water supply. Different uses may require different qualities as well as quantities of water. Supplies also vary according to quality and quantity. Because water quality is a critical factor in water supply, it should be specified in any consideration or presentation related to water quantity. The degree of detail used to describe water quality should be suitable to permit differentiation among water sectors or available water supply sources.

(6) Nonstructural measures and conservation. The without project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures. These measures include:

(a) Reducing the level and/or altering the time pattern of demand by metering, leak detection and repair, rate structure changes, regulations on use (plumbing codes), education programs, drought contingency planning;

(b) Modifying management of existing water development and supplies by recycling, reuse, and pressure reduction; and

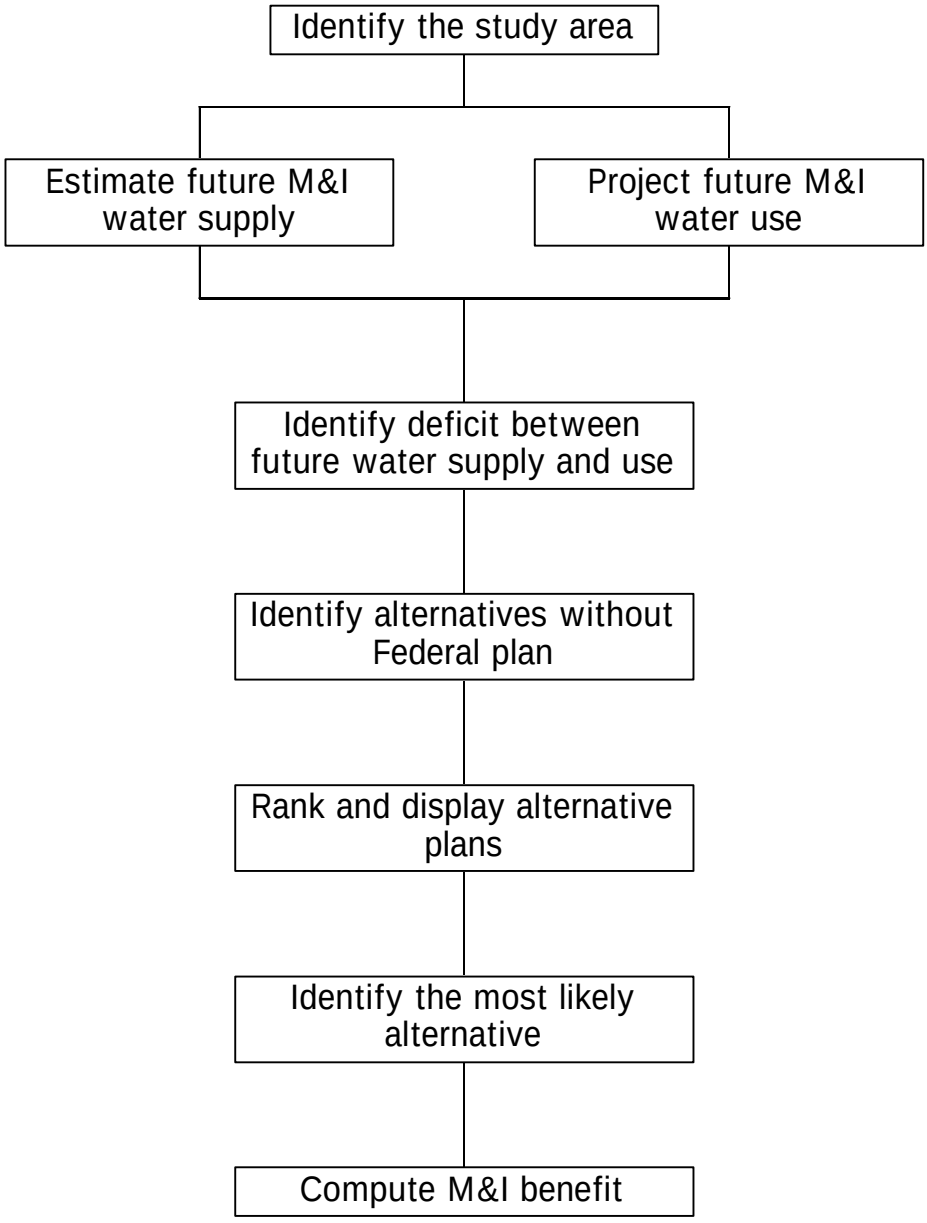
(c) Increasing upstream watershed management and conjunctive use of ground and surface waters.

b. With Project Condition. The with project condition is the most likely condition expected to exist in the future with the Federal water supply plan under consideration. The six elements and assumptions addressed in the without project condition should also be addressed in the with project condition. Nonstructural water supply measures may be used alone or in combination with structural measures. If the proposed measures are already in the process of implementation, they are part of the without project condition.

6-9. Evaluation Procedure: General. Follow the steps described in paragraphs 6-10 through 6-18 to estimate NED benefits that would accrue to one or more alternative plans for providing an M&I water supply (see Figure 6-1). The level of effort expended on each step depends on the nature of the proposed development, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to the estimate.

6-10. Evaluation Procedure: Identify Study Area. The study area is **the area** within which significant project impacts will accrue from the use of M&I water supplies, including areas that will receive direct benefits and/or incur costs from the provision of M&I water supply.

6-11. Evaluation Procedure: Estimate Future M&I Water Supplies. Prepare an analysis of all sources of supply expected to be available to the M&I water user. Data may be obtained from various sources, including water utilities, State and local planning agencies, and State water resources agencies. This analysis should be by time period and include existing water supplies, institutional arrangements, additional water supplies, probability of water supply, and water quality.


Identify the study area
Estimate future M&I water supply
Project future M&I water use
Identify deficit between future water supply and use
Identify alternatives without Federal plan
Rank and display alternative plans
Identify the most likely alternative
Compute M&I benefit

6-12. Evaluation Procedure: Project Future M&I Water Use. Project future water use by sector in consideration of seasonal variation. Base projections on an analysis of those factors that may determine variations in levels of water use.

a. Sector Analysis. Project future water use for the same time periods as for the supply projections for each of the following sectors: Residential (include indoor use and outdoor uses such as lawn irrigation and car washing); commercial (include water use for retail and wholesale trade, offices, hospitals, schools, medical lab (include all water used by manufacturing industries as an input in the production process); and additional uses (include public service use--for example, fire protection--and unaccounted-for losses.

b. Analysis by Time of Use. Identify seasonal variations in use for each of the above sectors and maximum day use for the system for each season.

c. Related Factors Analysis.

(1) Identify the determinants of demand for each sector. Use such determinants as price of water and sewer service; income; number and type of housing units and population per unit; industrial mix; and level of economic activity. Explain the variable projection of these factors as well as the extent to which they influence projection of water use in various sectors.

(2) Determine the relationship expected to exist between future levels of water use and the relevant determinants of water demand. Develop and use a forecast or forecasts of future levels of the determinants to project alternative future water use by sector and explain the choice of the particular forecast used.

d. Aggregation of Projections. Aggregate separate projections for each sector to a single projection by time period. (This should not, however, be viewed as a deterrent to meeting the needs of each sector by separate alternatives.)

6-13. Evaluation Procedure: Identify the Deficit Between Future Water Supplies and Use. Compare projected water use with future water supplies to determine whether any deficits exist in the study area. Make an analysis of the intensity, frequency, and duration of the expected deficits. Address deficits in three basic options: a. Reduce projected water use by implementation of nonstructural or conservation measures that are not part of the without project condition; b. increase and/or more efficiently use water supplies through structural measures; and c. accept and plan to manage water supply shortages. Plans generally are formulated to include some or all of these options.

6-14. Evaluation Procedure: Identify Alternatives Without Federal Plan. Identify alternative plans that are likely to be implemented by communities and/or industries in the absence of any Federal alternative. Test various alternatives to the Federal plans for acceptability, effectiveness, efficiency, and completeness as defined in paragraph 5-7b. These plans should be identified through analysis of the total water resources of the region, allowing for present and expected competing uses.

a. Consideration of alternative plans is not limited to those that would completely eliminate the projected gap between supply and demand. Plans that do not completely satisfy water supply objectives should also be considered. Include in such plans measures to minimize and allocate shortages when they occur (drought management measures). Balance the increased risk of occasional shortages against the savings from lesser investments that would increase the probability of occasional shortages. The costs of shortages include the costs of implementing drought management measures and the costs of related public health and safety measures.

b. Alternative plans need not be based on the development of a single source of supply at one time. They may consist of the development of a single source or the conjunctive development of several sources with increments phased to match anticipated growth in water use.

c. If institutional obstacles to implementation are noted, the plan should still be considered if the barriers are substantially within the power of the affected water users to correct. Include a detailed description of the institutional obstacles, with a discussion of the basis for any conclusion that the obstacles cannot be overcome.

6-15. Evaluation Procedure: Rank and Display the Alternative Plans Based on Least Cost Analysis.

a. Rank all of the alternatives in order from the highest cost alternative to the lowest. Calculate the annualized costs of the alternatives on the basis of the service (depreciable) life of the facility or the period of analysis, whichever is less.

b. Calculate costs of the alternatives on the following basis:

(1) Analyze all costs charged to the alternative on the basis of the Federal discount rate;

(2) No costs for taxes or insurance should be charged to the alternative; and

(3) All other assumptions and procedures used in calculating the costs of the alternatives, including external diseconomies, should be parallel to those employed in calculating the costs for the proposed Federal project.

6-16. Evaluation Procedure: Identify the Most Likely Alternative. Begin identification of the most likely alternative with the least costly. If an alternative with a lesser cost is passed over for a more expensive one, present the justification for not selecting the lower cost plan.

6-17. Evaluation Procedure: Compute M&I Water Supply Annualized Benefits.

a. Annualized benefits of the Federal water supply plan are equal to the annualized cost of the most likely alternative. When applicable, the evaluation should reflect differences in treatment, distribution, and other costs compared to the most likely alternative.

b. The alternative cost of providing a water supply for smaller communities (population of 10,000 or less) may be extremely expensive on a per capita basis because these communities lack the efficiencies of large-scale development. If such communities are not able to afford an alternative water supply comparable to the Federal water supply plan as identified in the procedure described above, the alternative should not be used as the basis for evaluating the benefits of the Federal water supply plan. In this case, the benefit may be considered equal to the cost of the separable M&I facilities plus an appropriate share of the remaining joint cost of the project. Provide documentation of the without project condition.

6-18. Evaluation Procedure: Problems in Application.

a. Two major problems exist in the application of this procedure. The first is identification of the value of conservation and other nonstructural measures. Examples of evaluation of conservation strategies, pricing methods, and drought management measures are available in technical publications.

b. A second major problem will arise over the disaggregation of water use by sectors. Some communities do not collect water use data by sectors. Where the system is fully metered, such data can be obtained by coding customer accounts and accumulating data on use for at least one year. Water use by unmetered customers may be estimated by extrapolating experience with similar metered systems, recognizing that unmetered customers face a price of zero. Verify that data and/or forecasts obtained from all sources are reliable and reasonable.

6-19. Report and Display Procedures. Tables 6-1, 6-2, and 6-3 are suggested presentations for reports that include municipal and industrial water supplies. Tables 6-1 and 6-2 summarize by time period (and season, if applicable) the projected use by sector,

projected supply by source, and the difference between the two for average day and maximum day, respectively. Table 6-3 shows the costs of alternative plans and the quantity supplied under each alternative by time period (season, if applicable).

Table 6-1
M&I Water Supplies--Without Project Condition
Average Day Use and Capacity

Projected average day water use[1]	Time Period[2]			
	P_1	P_2	P_3	P_N
Residential (mgd)	.....			
Commercial (mgd)	.....			
Industrial (mgd)	.....			
Additional (includes public services and unaccounted for losses) (mgd)	.....			
Total	.....			
Average day water supply capacity without a plan:				
Source 1 (mgd)	.....			
Source 2 (mgd)	.....			
Source 3 (mgd)	.....			
Source X (mgd)	.....			
Total	.....			
Difference between projected average day water use and supply without a plan (mgd)	.....			

[1]Include effects on nonstructural and conservation measures
[2]Show by time period and season where there are seasonal variations, e.g.

	P_1		

W	S	S	F

Table 6-2
M&I Water Supplies--Without Project Condition
Maximum Day Use and Capacity

Projected average day water use[1]	Time Period[2]			
	P_1	P_2	P_3	P_N
Residential (mgd)	.....			
Commercial (mgd).....	.....			
Industrial (mgd)	.....			
Additional (includes public services and unaccounted for losses) (mgd)	.....			
Total.....	.....			
Average day water supply capacity without a plan:				
Source 1 (mgd).....	.....			
Source 2 (mgd).....	.....			
Source 3 (mgd).....	.....			
Source X (mgd)	.....			
Total.....	.....			
Difference between projected average day water use and supply without a plan (mgd).....	.....			

[1]Include effects on nonstructural and conservation measures
[2]Show by time period and season where there are seasonal variations, e.g.

	P_1	
W	S	S	F

Table 6-3
M&I Water Supply Alternatives
[Period of analysis, price level, discount rate]

Alternatives	Annualized cost (in thousands of dollars)	Quantity supplied (mgd) time period[1]			
		P_1	P_2	P_3	P_N
Most likely alternative.....	.....	.....	.....	.....	.....
Recommended plan.....	.....	.....	.....	.....	.....
Other plans.....	.....	.....	.....	.....	.....

[1]Show by time period and season where there are seasonal variations

SECTION III - NED BENEFIT EVALUATION PROCEDURES: AGRICULTURE

6-20. Purpose. This section provides procedures for the evaluation of agricultural benefits from water resources plans. The benefits attributable to flood damage reduction, drainage, irrigation, erosion control and sediment reduction should be evaluated separately to the extent practical.

6-21. Conceptual Basis.

a. NED Benefits. The NED benefits are the value of increases in the agricultural output of the Nation and the cost savings in maintaining a given level of output. The benefits include reductions in production costs and in associated costs; reduction in damage costs from floods, erosion, sedimentation, inadequate drainage, or inadequate water supply; the value of increased production of crops; and the economic efficiency of increasing the production of crops in the project area.

b. Basic and Other Crops.

(1) Basic crops (rice, cotton, corn, soybeans, wheat, milo, barley, oats, hay, and pasture) are crops that are grown throughout the United States in quantities such that no water resources project would affect the price and thus cause transfers of crop production from one area to another. The production of basic crops is limited primarily by the availability of suitable land.

(2) On a national basis, production of crops other than basic crops is seldom limited by the availability of suitable land. Rather, production is generally limited by market demand, risk aversion, and supply factors other than suitable land. Thus, production from increased acreage of crops other than basic crops in the project area would be offset by a decrease in production elsewhere. In some parts of the Nation analysis of local conditions may indicate that the production of other corps is limited by the availability of suitable land. (Suitable land is land on which crops can be grown profitably under prevailing market conditions.) In this case, crops other than basic crops list above may also be treated as basic crops when measuring intensification benefits by farm budget analysis. (See paragraph 6-24d. to determine when other crops may be treated as basic crops.)

c. Benefit Categories. Agricultural benefits are divided into two mutually exclusive categories, depending on whether there is a change in cropping pattern:

(1) Damage reduction benefits, that is, benefits that accrue on lands where there is no change in cropping pattern between the with and without project conditions; and

(2) Intensification benefits, that is, benefits that accrue on lands where there is a change in cropping pattern. There is also a subcategory of intensification benefits called efficiency benefits, which accrue from reduced costs of production.

d. Measurement of NED Benefits.

(1) Damage reduction benefits. Damage reduction benefits are the increases in net income due to the plan, as measured by farm budget analysis. These income increases may result from increased crop yields and decreased production costs. **[ER 1105-2-101 requires risk-based analysis in all flood damage reduction studies. This includes studies where the primary damages occur to agricultural crops. The ER identifies key variables that will be specifically incorporated into the risk-based analysis. The identified hydrologic/hydraulic variables, discharge associated with exceedance frequency and conveyance roughness and cross-section geometry, apply to agricultural studies. However, the economic variables do not identify the key areas of uncertainty related to the stage-damage relationship in agricultural studies. The ER suggests that key variables in agricultural areas may be seasonality of flooding and cropping patterns. FOAs should incorporate the key variables that apply to their specific area in the risk-based analysis. Documentation of the key variables and the method of analysis should be incorporated in the PSP. Districts are under no requirement to use the economic variables identified in the ER (structure**

first floor elevation, content and structure values) for agricultural damages or to perform explicit risk-based analysis of agricultural structures if they do not affect the formulation of the project.]

(2) Intensification benefits. Intensification benefits are measure**(d)** either by farm budget analysis or by land value analysis. Intensification benefits from increased acreage of basic crops and other crops that are constrained by the availability of suitable land in the WRC assessment subarea (ASA) are measured as the net value of the increased production. Intensification benefits from increased acreage of other crops (except for acreage of crops to be treated as basic crops because they are land constrained) result when there are production cost savings. These production cost savings are called efficiency benefits and are measured as the difference between production costs in the project area and production costs on land elsewhere in the ASA.

(a) Farm budget analysis. On land where the intensification benefit is solely from increased acreage of basic crops (and crops to be treated as basic crops), benefits are measured as the change in net income (see paragraphs 6-24d. through 6-24g.). On land where the intensification benefit is from increased acreage of other crops, use the efficiency procedure found in paragraph 6-24h.

(b) Land value analysis. Intensification benefits alternatively may be measured as the difference in the value of benefiting lands with and without the plan. The market value of a parcel of land reflects the capitalized value of the expected net income that can be derived from the land. Therefore, the difference in market value of two parcels of land that are identical except for the provision of improved water conditions reflects the present value of the additional net income (i.e., the intensification benefit) that can be attributed to improved water management or supply. (See paragraph 6-24i.)

6-22. Evaluation Components. Evaluation of the impact of water management practices or control measures should consider the following components:

a. Cropping Patterns. Project the most probable cropping patterns expected to exist with and without the project. If project measures are designed to reduce damage or associated cost problems without changing cropping patterns, project the current cropping pattern into the future for both with and without project conditions.

b. Prices. Use normalized crop prices issued by the Department of Agriculture to evaluate NED agricultural benefits; adjustments may be made to reflect quality changes caused by floods or drought. **The Department of Agriculture provides commodity prices, and indexes of prices paid by farmers for purchased inputs, to Federal water resource agency planners for estimating benefits from water projects. In the past, for each crop two prices and for each purchased input two price indexes were reported. One was market clearing prices with Government crop support programs, the other was market clearing prices without the programs. As a result of Section 632 of Public Law 100-460 market clearing prices without Government crop support programs will no longer be reported. Economic evaluation will therefore necessarily use only prices with the support programs.** For crops not covered above, statewide average prices over the three previous years may be used.

c. Production Costs.

(1) Analyze production costs that can be expected to vary between the with and without project conditions. These may include the costs of equipment ownership and operation; production materials; labor and management; system operation, maintenance, **repair, rehabilitation** and replacement (OM**RR**&R); and interest payments. If costs associated with project measures (e.g., on-farm drainage or water distribution costs) are included in the project cost analysis, exclude them from production costs.

(2) Value purchased inputs at current market prices. Compute interest at the project discount rate. Value all labor, whether operator, family, or hired, at prevailing farm labor rates. Estimate management cost on the basis of the type of farming operation. The estimate normally is expected to be at least six percent of the variable production cost (the cost of equipment ownership and operation, production materials and labor, but excluding the cost of land and added capital improvements).

d. Crop Yields. Project current yields with average management in the project area to selected time periods. Adjust future yields to reflect relevant physical changes (e.g., erosion, drainage, water supply, and floodwater runoff) in soil and water management conditions. Increases in yields due to future improvements in technology may be included in the evaluation when realization of these benefits is dependent upon installation of the project. The costs associated with these improvements in technology should be accounted for in the analysis. Changes in yields, both with and without the project, should be projected consistently with the water management and production practices accounted for in the production cost analysis.

e. Livestock Production. In geographically isolated areas increased livestock production may depend on installation of the water resources project. Where this can be demonstrated, net income from additional livestock production may be included as a benefit. The test for dependency is whether the livestock feeds can economically be transported into or out of the area. Benefits cannot exceed the delivered cost of the livestock feed if it were purchased for use in the project area. Such purchase prices would automatically include the costs of transporting the feeds into the area.

f. Comparable Lands. Comparable lands are lands that have climate, aspect, slope, soil properties and water conditions similar to those of a given category of lands benefitting from a plan.

g. Land Values. The market value of lands method for estimating the economic benefits of alternative plans requires the involvement of qualified land appraisers with local experience. Use of this procedure is appropriate when:

(1) Lands to be affected by the proposed alternative plan are comparable to lands elsewhere which can be appraised;
(2) Water resources conditions on comparable lands are similar to those to be provided on lands affected by an alternative plan, and they can be identified and evaluated;

(3) Current market data are used to determine the value of capital improvements and other factors when making adjustments for these factors on comparable lands; and

(4) The estimated value of lands to be affected by the plan is not changed by speculation that Federal action is anticipated.

6-23. Planning Setting.

a. The without project condition, including conservation measures, is the condition expected to exist in the absence of an alternative plan.

b. The with project condition is the condition expected to exist with each alternative plan under consideration.

c. Agricultural income and production costs should be determined for various conditions or levels of land and water quantity and/or quality use. (Include other resources associated with changes in land and water quantity and/or quality.) The level of use to be evaluated initially is the without-plan condition. Other levels of use to be evaluated will depend on the number of alternative plans selected for analysis.

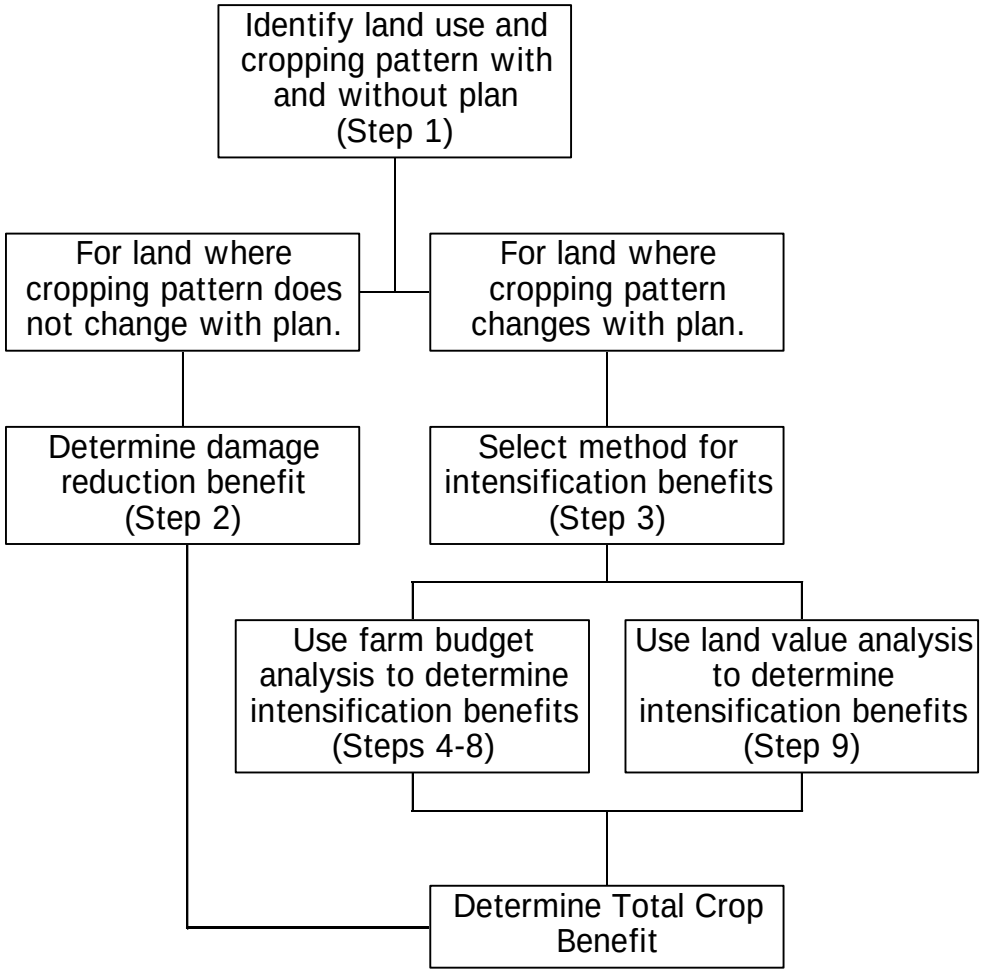
6-24. Evaluation Procedure: Crops. This procedure is for the evaluation of benefits to crop production that would accrue from an alternative plan. Steps in this procedure are summarized in Figure 6-2.

a. Step 1. Identify Land Use and Cropping Patterns With and Without a Plan. This information is generally developed for segments of the plan area with significantly different characteristics. Collect appropriate data about the current and historic cropping patterns and yields in the project area. When appropriate, collect similar data on other areas with comparable soils to determine conditions expected with alternative plans. Analyze trends and expected changes for without project conditions. Project future cropping

patterns and yields under without plan conditions. Include the effects of conservation and structural and nonstructural measures expected under existing programs. Project future cropping patterns and yields for each alternative plan. For analytical purposes, separate land in the project area into two categories: lands on which the cropping pattern is the same with and without the plan; and lands on which there would be a change in cropping pattern with the plan. To estimate crop production benefits on lands where there would be a change in cropping pattern, go to Step 3. To estimate crop production benefits on lands **where there would not be a change in cropping, proceed with Step 2.**

b. Step 2. Determine Damage Reduction Benefit. For land on which the cropping pattern would not change, determine the change in net income with and without a plan. This is the damage reduction benefit. Income increases may result from increased crop yields and decreased production costs. They are measured as reduced damage to crops from excessive soil moisture, water inundation, drought and erosion, and reduced costs associated with using water and land resources for the production of crops.

(1) Estimate reduced damage to crops from excessive soil moisture on the basis of the change in frequency and duration of excessive soil moisture. Estimate reduced damage to crops from water inundation on the basis of the change in frequency, depth, and duration of inundation. Estimate reduced damage from drought on the basis of the change in frequency and duration of inadequate soil moisture during the growing season. Estimate reduced damage from erosion on the basis of the change in land voiding from gully and streambank erosion and on the basis of the change in productivity losses from floodplain scour, sheet erosion, overbank deposition, and swamping.


Identify land use and cropping pattern with and without plan (Step 1)
For land where cropping pattern does not change with plan.
For land where cropping pattern changes with plan.
Determine damage reduction benefit (Step 2)
Select method for intensification benefits (Step 3)
Use farm budget analysis to determine intensification benefits (Steps 4-8)
Use land value analysis to determine intensification benefits (Step 9)
Determine Total Crop Benefit

(2) Estimate reduced costs associated with using water and land resources for the production of crops on the basis of the changes in the costs of equipment ownership and operation; production materials; labor and management; and system operation, maintenance, and replacement.

(3) Use farm budget analysis to measure changes in net income from reduced damage to crops and reduced costs of production.

c. Step 3. Select Evaluation Method for Estimating Intensification Benefits. For land on which the cropping pattern would change, select either farm budget analysis or land value analysis as the method for measuring intensification benefits. If land value analysis is selected, go to Step 9. If farm budget analysis is selected, proceed with Step 4.

d. Step 4. Determine Whether Other Crops Are to be Treated as Basic Crops. If the change in cropping pattern increases the acreage in production of other crops and if it is believed that the production of other crops is constrained by the availability of suitable land, the following test may be applied to determine whether these crops should be treated as basic crops in the benefit analysis. If the test is not applied, go to Step 8.

(1) Select a representative sample of farm operations on lands comparable to lands benefitting from the project under with project conditions where there would not be a change in cropping pattern, proceed with Step 2.

(a) For each farm operation determine the respective acreage of basic and other crops.

(b) Use these data to compute the proportion of other crop acreage to total crop acreage for each farm.

(c) Use farm budget analysis to identify the top 25 percent of farms in the representative sample in terms of expected net income per acre.

(d) The average of the proportions of other crop acreage to total crop acreage for the top 25 percent of farm operations is defined as the "optimal proportion". The optimal proportion for these farm operations will reflect risk and uncertainty, returns to management, and prevailing market conditions.

(2) If it can be demonstrated through standard statistical tests that the optimal proportion is not statistically different from the proportion computed as the average of individual farm operation proportions for the complete sample, then the production of other crops can be considered to be constrained by the availability of suitable land in the ASA and, therefore, treated as basic crops. Otherwise it can be inferred that production of other crops is not land constrained in the ASA. When the crops are not land constrained, go to Step 8; otherwise, proceed with Step 5.

e. Step 5. Determine Limit on Acreage of Other Crops That May be Treated as Basic Crop Acreage. If the production of the other crops is found to be constrained by availability of suitable land in the ASA, then multiply the acreage of comparable land in the project area by the optimal proportion found in Step 4(a). This is the maximum acreage of other crops that may be analyzed using the steps that apply to basic crops (Steps 6 and 7). To analyze benefits for any acreage of other crops in excess of this maximum acreage, go to Step 8.

f. Step 6. Project Net Value of Agricultural Production With and Without the Plan. Use information from farm budget analysis to estimate the net value of agricultural production under without plan conditions. Estimate the net value of agricultural production associated with each of the alternative plans. Account for variable costs related to production. Include non-project OM&R costs and associated costs for each alternative plan.

g. Step 7. Compute Intensification Benefits for Acreage of Basic Crops and Other Crops to be Treated as Basic Crops. Compute intensification benefits as the change in net income between the without project condition and conditions with an alternative plan. Express these intensification benefits in average annual equivalent terms. This completes the analysis of benefits for lands with increased acreage of basic crops and other crops that are to be treated as basic crops.

h. Step 8. Determine Efficiency Benefits. Compute efficiency benefits for acreage producing other crops not treated as basic crops as the sum of:

(1) The difference between the cost of producing the crops in the project area and the cost of producing them on other lands in the ASA; and

(2) The net income that would accrue from production of an appropriate mix of basic crops on those other lands. Express this efficiency benefit in average annual equivalent terms.

I. Step 9. Land Value Analysis. When estimating intensification benefits on the basis of land value analysis, base appraisals on market values, not on capitalized income values.

(1) Obtain appraisals of the current market value of lands that would benefit from the plan. These lands should be divided into various categories where values differ significantly.

(2) Obtain and appropriately adjust appraisals of non-project lands in the ASA that are comparable to lands in each category of project lands and that have water conditions comparable to those that would result from each alternative plan.

(a) Adjust the value of these comparable lands for facilities and other capital improvements that are not present on project lands. For example, subtract the current market value of improvements such as investments in orchards.

(b) In the case of irrigation projects, add to the appraised value of comparable lands the present value of water costs incurred by the operator. These water costs include both payments to outside suppliers and the cost of self-supplied water. Use the project discount rate to calculate the present value of these costs.

(c) Control for other factors that may affect the value of land, such as kinds of crops grown, distance to urban areas, availability of transportation facilities, presence of utilities, zoning regulations, and special property tax rates. This control may be achieved by using totally comparable parcels of lands; by collecting a sample large enough so that differences will be averaged out; or by a statistical means such as regression analysis.

(3) Subtract the value in paragraph 6-24i(1) from the adjusted value in paragraph 6-24i(2). This is the intensification benefit.

(4) Annualize the intensification benefit found in paragraph 6-24i(3) just before at the project discount rate.

6-25. Evaluation Procedure: Damage Reduction For Other Agricultural Properties and Associated Agricultural Enterprises.

a. Determine Damage Reduction for Other Agricultural Properties. The term "other agricultural properties" includes physical improvements associated with various farm enterprises and the agricultural community. Measure benefits to such properties as reduction in damages in the future with the project compared to without the project. The following discussion identifies key analytical steps in the evaluation. Benefits accrue through alterations in water conditions or in altering the susceptibility of the property to damage (e.g., flood proofing).

(1) Inventory damageable improvements. Identify the location, type, number, and value of other agricultural properties within the area that are subject to damage. This information is most easily obtained through interviews of farmers and field reconnaissance.

(2) Determine damage to improvements. Gather historical data on damages to other agricultural properties, such as equipment, improvements, and agricultural enterprises.

(3) Determine average annual equivalent damage to improvements. Use appropriate data to determine average annual equivalent damage to improvements. For example, use depth-damage relationships for each reach, integrated with hydrologic data, to develop average annual flood damages with and without the plan. Include consideration of the frequency and duration of the damage.

b. Determine Damage Reduction Benefits for Associated Agricultural Enterprises. Associated agricultural enterprises are economic activities that may be affected by changed water supply or water management conditions. Evaluate damages of this type as reduced net income under without project and with project conditions. An example of this type of damage is delay in spring planting on flood free lands because of flooding of access roads.

c. Calculate Average Annual Equivalent Benefits. The damage reduction benefit is the difference between average annual equivalent damages with and without the plan.

6-26. Evaluation Procedure: Off-site Sediment Reduction. Determine average annual equivalent sediment damages by adding the costs in constant dollars of removing sediment from roads, culverts, channels, etc., over a representative period of time and dividing by the years of record. The difference in damages with and without the project is the benefit. Extending the useful life of an existing reservoir is another type of sediment reduction benefit. Discount the net value of the extension to present values, and amortize it over the project life. The increased cost of providing goods and services (e.g., additional treatment costs for removing sediment from municipal water) can also be used to evaluate damages. Reductions in the costs of sediment removal or water treatment provide the basis for assessing benefits with the plan.

6-27. Evaluation Procedures: Problems in Application.

a. Damage Reduction Benefits. Damage reduction benefits are measured by farm budget analysis. Proper measurement of such benefits requires accurate estimates of with and without plan soil, water, and land use conditions. Changes in physical conditions take place at different rates and over different time periods. Analysis can be improved by projecting changes in physical conditions to selected time periods, analyzing net income for the time periods, and converting net income for the time periods to an average annual equivalent value. In farm budget analysis, double counting can be avoided by taking a holistic approach (including all soil, water and land use conditions in a single farm budget analysis).

b. Determination of Land Constraint. Intensification benefits for other crops are measured either as a change in net income or as an efficiency gain depending on whether there is an adequate supply of suitable land in the region for growing crops other than basic crops (that is, whether production is land constrained). This determination requires a regional (ASA) analysis of comparable lands. In order to make this determination properly, care must be exercised to ensure that lands being evaluated are fully comparable. Care must also be exercised in order to obtain the proper determination of aggregate acreage of basic and other crops for the top 25 percent of the farms. (See paragraph 6-24d(1).)

c. Benefit Attribution. In flatland watersheds, drainage and flood damage reduction benefits cannot be separated analytically. Therefore, they are arbitrarily allocated on a 50/50 basis. The value of benefits in other categories is determined on the basis of changes in physical conditions with and without the plan. The benefits are assigned according to the following: the proportion of the change in net income attributed to changes in soil moisture, water inundation, drought and erosion; the proportion of land use changes attributed to each of the above; and changes in production costs attributed to each of the above. Except for the problem with drainage

and flood damage reduction in flatland watersheds, benefits can be measured independently if proper assumptions are made to avoid double counting. Double counting can be avoided by making sure that total benefits measured independently do not exceed total benefits from a holistic farm budget analysis.

d. Residual Damages. In evaluating with plan conditions, care must be taken to consider residual damages, that is, damages that would still occur with implementation of the plan.

e. Land Value Analysis. Because proper land value analysis is dependent on accurate appraisals, the appraisals on which this analysis is based should be performed by qualified land appraisers. Adjustment of appraised values of lands comparable to project lands to account for capital improvements, costs of water supply, and other factors affecting the values requires detailed knowledge of local physical and financial conditions.

[f. Agricultural intensification benefits cannot exceed the increased flood damage potential when the existing cropping pattern is compared to the intensified cropping pattern (without the proposed plan).]

g. Agriculture: Swampbuster. The Food Security Act of 1985 (Public Law 99-198) contains provisions known collectively as "Swampbuster". Their intent is to discourage conversion of farm wetlands. The Swampbuster provisions were implemented as a USDA final rule (7 CFR 12), effective 17 September 1987.

(1) Conversion of wetlands is discouraged by imposing penalties on farmers who plant commodity crops on lands that were converted from wetlands after 23 December 1985. The penalty is loss of a wide variety of Agriculture Department program benefits, including all types of price supports or payments; crop insurance; access to loans made, insured, or guaranteed by FMHA; and others. If imposed, the penalty applies to all holdings of the farmer, not just to the acres that were converted and cropped.

(2) More information about the purposes, policies, and procedures of the Swampbuster program are contained in the final rule cited above. Details about the program, and its management and administration, as well as determinations of its applicability to specific Corps projects can be obtained through the regional offices of the USDA Soil Conservation Service.

(3) Without and With Project Analysis. The effects of the Swampbuster program shall be explicitly considered in without and with project conditions.

(a) Benefit evaluation. The effects of the program will operate through farm operator decisions to convert and cultivate on-farm wetlands. Particularly important for benefit evaluation is with project condition analysis, as a Corps project may by itself convert wetlands to non wetlands, or may make additional private conversion investments more profitable. The Swampbuster program, however, may modify incentives sufficiently to alter with project cropping plans, and may even affect support for particular projects.

(b) Incremental cost of mitigation analysis. Swampbuster will have no effect procedurally on the analysis of the incremental cost of mitigation. It may affect the amount of wetland loss expected in the without project condition, the amount of any wetland preservation credit due the project, and through these the total amount that will be considered for mitigation (See Chapter 7).

6-28. Evaluation Procedure: Data Sources.

a. Interviews. Interviews with farmers and other area residents are important for most of the categories of benefits to be evaluated. Interviews should not be confined to farmers in the project area. Data collected outside the project area serves as a comparative basis for estimating damages and yields in the project area. Use only interview forms approved by the Office of Management and Budget. In the project report, the questionnaire and a summary of responses should be compiled and displayed in such a way as to prevent the disclosure of individual sources.

b. Physical Specialists. Agronomists and soil scientists can provide data to establish yield estimates by soil type and the effects on production of soil depletion or sediment deposition.

c. Universities and Federal Agencies. Many universities and the Department of Agriculture have developed typical enterprise budgets that can be modified to reflect conditions in the area being studied.

d. Land Appraisers. Market values of project lands and comparable lands should be provided by qualified land appraisers.

[e. IWR Report. Additional detailed support material for conducting NED evaluation may be found in Agricultural Flood Damage (IWR Report 87-R-10, October 1987). This manual provides an expanded description of agricultural benefit evaluation procedures. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within this IWR report.]

6-29. Report and Display Procedures. A clear presentation of the study results will facilitate review. Tables 6-4 and 6-5 are suggested presentations.

Table 6-4
Summary of Crop Benefits
(Farm Budget Analysis Method)

Item	Current	Base	Year[a]	Year[a]	Year[a]	Year[a]	Year[a]	Annualized Value[b]
Without Plan								
Acres:								
basic crops								
other crops								
Value of agricultural production								
Agricultural production costs								
With Plan								
Acres:								
basic crops								
other crops								
Value of agricultural production								
Agricultural production costs								
NED BENEFITS								

[a]Annual value at the given year.
[b]Annualized at ___ percent discount rate.

Table 6-5
Intensification Benefits
(Land Value Analysis Method)

Item	Current Year	Annualized[a]
Without Plan		
Value of agricultural land		
With plan		
Value of agricultural land		
INTENSIFICATION BENEFIT		

[a]Annualized at ____ percent discount rate

SECTION IV - NED BENEFIT EVALUATION PROCEDURES: URBAN FLOOD DAMAGE

6-30. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the urban flood hazard reduction features of water resource plans and projects.

6-31. Conceptual Basis.

a. General. Benefits from plans for reducing flood hazards accrue primarily through the reduction in actual or potential damages associated with land use.

b. Benefit Categories. While there is only one benefit standard, there are three benefit categories, reflecting three different responses to a flood hazard reduction plan.

(1) Inundation reduction benefit. If floodplain use is the same with and without the plan, the benefit is the increased net income generated by that use. If an activity is removed from the flood plain, this benefit is realized only to the extent that removal of the activity increases the net income of other activities in the economy. **[ER 1105-2-101, Risk-Based Analysis for Evaluation of Hydrology/Hydraulic and Economics in Flood Damage Reduction Studies, requires risk-based analysis in all flood-damage reduction studies. The regulation and the complementary EM 1110-2-1619 provide the evaluation framework to be used in these studies. The regulation identifies key variables that must be explicitly incorporated into the risk-based analysis. At a minimum, the stage-damage function for economic studies (with special emphasis in structure first floor elevation, and content and structure values for urban studies); discharge associated with exceedence frequency for hydrologic studies; and conveyance roughness and cross-section geometry for hydraulic studies must be incorporated in the risk-based analysis. The ER further requires a probabilistic display of benefits and eliminates freeboard to account for hydraulic uncertainty.]**

(2) Intensification benefit. If the type of floodplain use is unchanged but the method of operation is modified because of the plan, the benefit is the increased net income generated by the floodplain activity.

(3) Location benefit. If an activity is added to the floodplain because of a plan, the benefit is the difference between aggregate net incomes (including economic rent) in the economically affected area with and without the plan.[1] **(Policy Guidance Letter #25 constrains the use of location benefits)**

c. Types of Flood Damage. Flood damages are classified as physical damages or losses, income losses, and emergency costs. Each activity affected by a flood experiences losses in one or more of these classes.

(1) Physical damages. Physical damages include damages to or total loss of buildings or parts of buildings; loss of contents, including furnishings, equipment, **automobiles,** decorations, raw materials, materials in process, and completed products; loss of roads, sewers, bridges, power lines, etc.

(2) Income loss. Loss of wages or net profits to business over and above physical flood damages usually results from a disruption of normal activities. Estimates of this loss must be derived from specific independent economic data for the interests and properties affected. Prevention of income

loss results in a contribution to national economic development only to the extent that such loss cannot be compensated for by postponement of an activity or transfer of the activity to other establishments.

(3) Emergency costs. Emergency costs include those expenses resulting from a flood what would not otherwise be incurred, such as the costs of evacuation and reoccupation, flood fighting, **cleanup including hazardous and toxic waste cleanup,** and disaster relief; increased costs of normal operations during the flood; and increased costs of police, fire, or military patrol. Emergency costs should be determined by specific survey or research and should not be estimated by applying arbitrary percentages to the physical damage estimates.

6-32. Planning Setting.

a. General. The benefit of flood hazard reduction plans is determined by comparison of the with and without project conditions.

b. Without Project Condition. The without project condition is the land use and related conditions likely to occur under existing improvements, laws, and policies. There are three significant assumptions inherent to this definition:

(1) Existing and authorized plans. Existing flood hazard reduction plans are considered to be in place, with careful consideration given to the actual remaining economic life of existing structures. Flood hazard plans authorized for implementation but not yet constructed are evaluated according to the relative likelihood of actual construction. If there is a high likelihood of construction, the authorized plan is considered to be in place.

(2) Flood Disaster Protection Act. The adoption and enforcement of land use regulations pursuant to the Flood Disaster Protection Act of 1973 (Public Law 93-234) is assumed.

(a) Regulation certified or near certification. If the local land use regulation has been or will be certified, partially waived, or adjusted by the Flood Insurance Administration (FIA) as adequate under 24 CFR 1910.3(c) and/or (d) and 24 CFR 1910.5, that regulation defines the without project condition.

(b) Regulation not yet certified. It is assumed that the local jurisdiction will adopt in the near future land use regulations certifiable to FIA under the without project condition as a datum and under the with project condition if a residual hazard will remain. This applies to flood plains regulated under 24 CFR 1910.3(a) and (b); to flood plains regulated by local ordinances independent of FIA; and to floodplains with no flood regulation in effect. For riverine situations, the following two crucial features are included: no future confinement or obstruction of the regulatory floodway; and no future occupancy of the flood fringe unless residences are elevated to or above 100-year flood level and nonresidence are flood proofed to that level.

(c) Application. It is assumed that flood proofing costs will be incurred if an activity decides to locate in the flood plain.

(3) Executive Orders. Compliance with E.O. 11988, Floodplain Management and E.O. 11990, Protection of Wetlands, is assumed.

(4) Individual actions. In addition to the three assumptions stated in paragraphs 6-32b(1), (2), and (3), the analyst shall consider the likelihood that individuals will undertake certain flood hazard reduction measures, such as flood proofing, when the cost of such measures is reasonable compared to the costs of potential flood damages.

c. With Project Condition. The with project condition is the most likely condition expected to exist in the future if a specific project is undertaken. There are as many with project conditions as there are alternative projects.

(1) In projecting a with project condition, the analyst must be sensitive to the relationship between land use and the characteristics of the flood hazard for the alternative project being analyzed.

(2) The same assumptions underlie the with project condition and without project conditions.

(3) Consideration should be given to both structural and nonstructural alternatives and to alternatives incorporating a mix of structural and nonstructural measures. Non structural measures include:

(a) Reducing susceptibility to flood damage by land use regulations, redevelopment and relocation policies, disaster preparedness, flood proofing, flood forecasting and warning systems, flood plain information, flood plain acquisition and easements; and

(b) On-site detention of flood waters by protection of natural storage areas such as wetlands or in manmade areas such as building roofs and parking lots.

(4) Since project alternatives can differ in their physical characteristics, the optimal timing of projects and of individual project features should be considered in project formulation.

6-33. Evaluation Procedure: General. Ten steps are involved in computing benefits (see Figure 6-3). The steps are designed primarily to determine land use and to relate use to the flood hazard from a NED perspective. The level of effort expended on each step depends on the nature of the proposed improvement and on the sensitivity of the project formulation and justification to further refinement. The first five steps result in a determination of future land use; emphasis is on evaluating the overall reasonableness of local land use plans with respect to: a. OBERS and other larger area data, and b. recognition of the flood hazard.

6-34. Evaluation Procedure: Step 1--Delineate Affected Area. The area affected by a proposed plan consists of the flood plain plus all other nearby areas likely to serve as alternatives sites for any major type of activity that might use the flood plain if it were protected; one example of a major activity-type is commercial. If the potential use of the flood plain includes industrial use within a standard metropolitan statistical area (SMSA),the entire SMSA is the affected area; for residential use, even within an SMSA, a much smaller area may be designated the affected area.

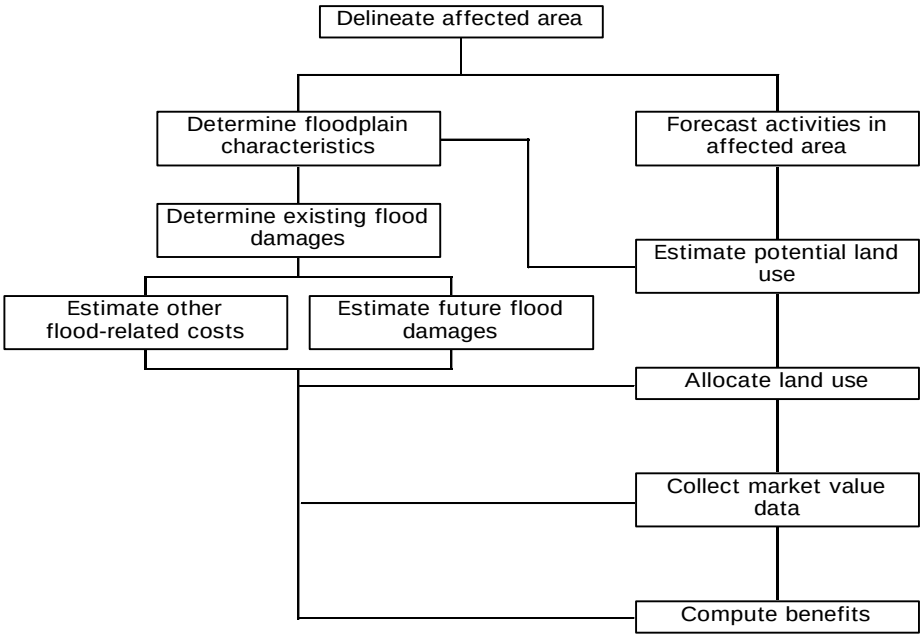


Figure 6-3. Flowchart of Urban Flood Damage Benefit Evaluation Procedures

6-35. Evaluation Procedure: Step 2--Determine Flood Plain Characteristics. The existing characteristics of the flood plain must be determined before its actual use can be estimated; therefore, undertake an inventory of the flood plain to determine those characteristics that make it attractive or unattractive for the land use demands established in steps 3 and 4, with emphasis on those characteristics that distinguish the flood plain from other portions of the affected area. Use the following categorizations as a guide:

a. Inherent Characteristics of a Flood Plain. Flood plain characteristics may include:

(1) Flooding. Describe the flood situation, including a designation of high hazard areas. The description should include characteristics of the flooding, such as depths, velocity, duration, and debris content; area flooded by floods of selected frequencies, including 100-year frequency; historical floods, and, where applicable, larger floods. **[Informational description of flood characteristics for a given frequency or discharge should be based on the median probability discharge. In all cases the regulatory floodplain as defined by the National Flood Insurance Program will be described.]**

(2) Floodway, natural storage. Describe and delineate those areas which, if urbanized or structurally protected, would affect natural storage, velocity, or stage, or would affect flood flows elsewhere.

(3) Natural and beneficial values, including open space, recreation, wildlife, and wetlands. Many flood plains, particularly those near urban areas, are potential recreation, open space, wetland, or wildlife preserves. The potential of the flood plain for these purposes should be recognized and presented.

(4) Transportation. Flood plains near navigable streams have inherent attractiveness for industries that demand water-oriented transportation. Flood plains also serve as sites for railroads, highways, pipelines, and related facilities that are not susceptible to serious flood damage but have a tendency to attract industry to the area. **[These statements may not necessarily be true in all areas. Flood damage to transportation systems and the resulting transportation delay costs may be an important damage category in many urban settings. Care should be taken to adequately address transportation delay costs in both the without and with project condition.]**

(5) Other attributes. Other inherent attributes of flood plains may include soil fertility, reliability of water supply, waste disposal, and sand, mineral, and gravel deposits.

b. Physical Characteristics. Describe pertinent physical characteristics, including slope, soil types, and water table.

c. Available Services. Most activities require some or all of the following services: transportation (highway and rail), power, sewerage, water, labor, and access to markets. Indicate the availability of such services in or near the flood plain, including comparisons with similar services available in other portions of the affected area.

d. Existing Activities. Include in the inventory of the flood plain a list of existing activity types, the number of acres, and the density, age, and the value of structure of each activity-type by flood hazard zone.

6-36. Evaluation Procedure: Step 3--Project Activities in Affected Areas. Base economic and demographic projections on the most recent available studies and include the following: population, personal income, recreation demand, and manufacturing, employment, and output. Additional projections may be necessary for any given area, depending on the potential uses of these projections. Base projections on assessment of trends in larger areas and appropriate data (e.g., OBERS); the relationship of historical data for the affected area to trends projected for larger areas; and consultation with knowledgeable local officials, planners, and others. The basis for the projections should be clearly specified in the report. **[Estimates of future growth benefits shall be based on current unbiased economic growth indices. Whenever possible the growth indices should be independent estimates. Paragraph 4-11(2) and 6-32b.(2)(b) requires that for the without project condition, floodplain communities will be assumed to belong to the National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency. In order to participate in this program, the local community must preclude new development in the regulatory floodway as defined by the community, and require that new development in the NFIP regulatory flood plain outside of the floodway be constructed with first floor elevations at or above the .01 probability elevation (formerly described as the 100-year elevation). Therefore, future development will be assumed to be protected to the .01 probability discharge (formerly described as the 100-year discharge) at the end of the period of analysis. The .01 probability discharge and elevation will be determined by the Corps consistent with levee certification guidance. If individual communities have floodplain restrictions more stringent than NFIP criteria, projections of future development should reflect the local criteria. However, under no circumstances, will future development be assumed in any area subject to flooding in the present and future .01 probability flood.]**

6-37. Evaluation Procedure: Step 4--Estimate Potential Land Use. Estimate potential land use within the affected area by converting demographic projections to acres. The conversion factors can normally be derived from published secondary sources, from agency studies of similar areas, or from empirical and secondary data available in the affected area. The categories of potential land use need be only as detailed as necessary to reflect the incidence of the flood hazard and to establish the benefits derived from a plan.

6-38. Evaluation Procedure: Step 5--Project Land Use. Allocate land use demand to flood plain and non flood plain lands for the without project condition and for each alternative flood plain management plan.

a. Basic Factors. Base the allocation on a comparison of the flood plain characteristics, the characteristics sought by potential occupants, and availability of sought-after characteristics in the non flood plain portions of the affected area.

b. Criteria. The flood plain should not be used unless it has characteristics that give it a significant economic advantage to the potential user over all other available sites within the affected area. If such advantages exist, determine whether they overcome potential flood losses, potential flood proofing costs, and the costs of other related hazards. Flood losses and costs should be specific to the zone of the floodplain being considered.

6-39. Evaluation Procedure: Step 6--Determine Existing Flood Damages. Existing flood damages are the potential average annual dollar damages to activities affected by flooding at the time of the study. Existing damages are those expressed for a given magnitude of flooding or computed in the damage frequency process. No projection is involved. The basis for the determination of existing damages is

losses actually sustained in historical floods; therefore, specify the year and month of all significant recorded discharges above zero point of damage and indicated the damages actually sustained by reach or zone and type of property and activity. Historical data are often incomplete; urbanization and other changes will have occurred over the years. Many streams and reaches do not have gaging stations. Therefore, data on historical flood losses should be carefully scrutinized and supplemented by appraisals, use of area depth-damage curves, and an inventory of capital investment within the flood plain. Further, estimates of damages under existing conditions should be computed for floods of magnitude that have not historically occurred. Estimate average annual losses by using standard damage-frequency integration techniques and computer programs that relate hydrologic flood variables such as discharge and stage to damages and to the probability of occurrence of such variables. Annual hydrologic data are normally sufficient for urban drainage estimates. Access flood damages by activity-type and by whether they are borne by the owner or by the public at large.

6-40. Evaluation Procedure: Step 7--Project Future Flood Damages. Future flood damages are the dollar damages to economic activities identified in step 3 that might use the floodplain in the future in the absence of a plan. Use this step in combination with step 5 (land use) to determine land use and associated damages for each future with project and without project condition. "Future" is any time period after the year in which the study is completed; in order to relate costs ultimately to benefits, however, future damages must be discounted to the base year. Determine future flood damages on the basis of losses sustained both by the flood plain occupant and by others though insurance subsidies, tax deductions for casualty losses, disaster relief, etc.

a. Hydrologic Changes. Changes in basin land use may result in major alteration of drainage characteristics, particularly surface runoff; project such hydrologic changes for the planning period. Average future hydrologic conditions should not be used, since they obscure situations in which the level of protection afforded by a project may be significantly different from average conditions by the end of the planning period.

b. Economic Changes. Economic changes can be expected to result in a change in the level of future flood losses. A benefit-cost ratio for the existing condition should always be shown. If the ratio is greater than 1:1, the projection of future benefits may be accomplished in abbreviated form unless it would distort the comparison of alternative projects or the cost allocation and cost sharing in multipurpose projects. In the latter situation, the detail and accuracy of the estimates of flood control benefits should be comparable to the estimates of benefits for other water resources purposes.

c. Projection of Physical Damages. Base measurement and projection of flood damages on the establishment of actual, observed relationships between damages, flood characteristics, and those indicators used for measurement and projection. These relationships should be modified as appropriate by consideration of constraints that change the historically derived relationship between flood damages and a given indicator. The relationships should be made explicit in the report and their accuracy and representativeness supported, to the extent possible, by empirical evidence. Use three steps in measuring flood damages for a future year: estimate the number and size of physical units; estimate the future value of units; and determine the damage susceptibility of units.

(1) Physical units. The first step in measuring flood damages for a future year is to determine from step 2 (paragraph 6-35.) the number and size of physical units with potential to use the flood plain by hazard zones for each activity type. Care must be taken to determine whether existing structures

will continue to occupy the flood plain over the period of analysis and, if not, the future land use and damage potential of new structures.

(2) Value per physical unit. This step involves estimating future unit value. Increases in the value of property in the flood plain may result from the expansion of existing facilities or the construction of new units. The following guidance applying to content value is derived from an empirical study of flood-prone property.

(a) Existing development. Use the OBERS regional growth rate for per capita income as the basis for increasing the real value of residential contents in the future.

(b) Future development. Project the value of contents within new residential structures from the year each unit is added.

(c) Translation to future flood damages. Use the projected rate of increase in the value of flood-susceptible household contents as the basis for increasing the future unit flood damage to household contents.

(d) Limit. The value of contents should not exceed 75 percent of the structural value of the residence unless an empirical study proves that a special case exists (e.g., trailer parks), nor should the increase in value of household contents be projected beyond project year 50. **[Current guidance on content-to-structure ratios is provided in para. 6-46.]**

(e) Commercial and industrial property. The procedure described for residential contents does not apply to commercial and industrial categories.

(3) Damage susceptibility. The third step in measuring future flood damages is to determine the damage susceptibility of units. Once the number of physical units and the value associated with each unit are known, examine possible future changes, if any, in damage susceptibility relationships as a function of the total value of each physical unit and the stream's flood characteristics, such as velocity, depth, duration, volume, debris load, and salinity. Some of the determinants of damage susceptibility are type of activity, vertical development, location within the flood plain, nature of flood proofing, construction material used, and individual response.

(a) Projection of Income Losses. Income losses may be projected to increase on the basis of projected land use. Increases in physical losses should not be used to project income losses.

(b) Projection of Emergency Costs. Emergency costs encompass a wide variety of programs. Some, such as emergency shelter and food, are primarily a function of occupancy of the flood plain but not of the value of development in the flood plain. Emergency costs should not be projected to increase as a direct function of physical losses.

(4) Use of Assessed Value Real Estate Appraisal and Market Value Data in Flood Damage Reduction Studies. Flooding causes physical damages to structures. In the past the Corps frequently estimated damages and cost of repair directly. The Corps now uses a risk-based procedure as defined by ER 1105-2-101. This procedure requires the use of depth-damage curves, which express an average relationship between depth of flooding and damages. Damages are expressed as a percentage of structure value. When depth-damage curves are used, the correct measure of structure value,

consistent with cost-benefit concepts, is replacement cost less depreciation to the existing (pre-flood) structure.

(a) Replacement cost is the cost of physically replacing (reconstructing) the structure (only). Depreciation accounts for deterioration occurring prior to flooding, and variation in remaining useful life of structures.

(b) Assessed value, real estate appraisal and market value data do not necessarily provide acceptable and directly useable estimates of replacement cost less depreciation, even when separate land and improvement values are reported. A variety of particular causes may make the data inappropriate, but the fundamental reason is that these data are produced for and primarily used for purposes other than estimation of flood damages, that is for other than NED benefit estimation purposes.

(c) Such data has some advantages for Corps planners as it is generally available and can be relatively inexpensive. Furthermore, in many cases such data may be useable, either directly or as modified. The appropriateness of the data must be verified however.

(d) When real estate appraisals are used as a source of basic data, the appraisal process shall be documented.

(e) Requirement. When structure value data is obtained from sources other than direct estimation of cost of physical replacement less depreciation, these data shall be verified as being reasonable estimates of replacement cost less depreciation. This can be done using a sampling procedure to select a relatively small number of structures for direct estimation of replacement cost less depreciation. The results can be used to compare to, and if appropriate, adjust the data obtained from other sources.

6-41. Evaluation Procedure: Step 8--Determine Other Costs of Using the Flood Plain. The impact of flooding on existing and potential future occupants is not limited to flood losses. Some of the impacts are intangible but others can be translated into NED losses. These latter include the following:

a. Flood Proofing Costs. High flood hazards lead to high flood costs. Therefore, compute the flood proofing costs of different activity-types and different flood hazard zones.

b. National Flood Insurance Costs. A national cost of the flood insurance program is its administration. The cost of servicing flood insurance policies in effect at the time of the study is the average cost per policy, including agent commission, and the costs of servicing and claims adjusting. FIA should be contacted to obtain these costs.

c. Modified Use. In some cases, the flood hazard has caused structures to be used less efficiently than they would be with a project. For example, the first floor of garden apartments may not be rented because of a flood hazard, or property may be configured in a different way with the plan compared to without a plan.

6-42. Evaluation Procedure: Step 9--Collect Land Market Value and Related Data. If land use is different with and without the project, compute the difference in income for the land. This is generally

accomplished by using land market value data. Provide supporting data in the situations described in paragraphs 6-42a. through 6-42d.

a. Land Use is Different With Project. If land use is different with compared to without the project, collect the following data as appropriate to complete step 10.

(1) Comparable value. If the plan does not result in a major addition to the supply of land in the area, the value with protection is the market value of comparable flood-free land. If the plan results in a major addition to the supply of land, the effect on the price of land should be taken into account in estimating the value of flood plain lands with protection. The flood-free land should be comparable in terms of physical and infrastructural characteristics.

(2) Existing value. Use the value of nearby flood plain sites or, as appropriate, the current value of the flood plain. In either case, report the current and, if available, past market values of the flood plain. Use actual market values, not capitalized income values. Therefore, it should not be assumed that the value of land being used for agriculture in an urban or urbanizing situation is the capitalized value of agricultural returns or that nay**(any)** value higher than this is due to speculation that a Federal project will be constructed or lack of knowledge. On the contrary, without project land values in excess of agricultural land values should be expected, reflecting the probability of future use as well as existing and anticipated infrastructural investments.

(3) Net income data. The net income (earned) with a project may be estimated directly based on an analysis of a specific land use with the project. This approach would be used, for example, for lands to be developed for recreation; the projected recreation benefits would constitute the gross income earned on the flood plain and would be shown as a project benefit.

(4) Encumbered title market value. Estimate the market value of land with an encumbered title for inclusion as a benefit in step 10 in situations in which the flood plain is to be evacuated, no specific public use is planned, and the land could be resold with an encumbered title (which would ensure that future uses would be consistent with Executive Order 11988--Floodplain Management, May 24, 1977).

b. Land Use is Same But More Intense With Project. If land use is the same but more intense, as when an activity's use of the floodplain is modified as a result of the project, base determination of the increase in income on increased land values or direct computation of costs and revenues.

c. Evacuation Plan. In the case of an evacuation plan, changes in market value of properties adjacent to a restored floodplain may reflect recreation or open-space benefits to occupants of those properties. Document such an NED benefit by empirical evidence. Care must be taken to avoid double counting of benefits.

d. Market Value is Lowered by Flood Hazard. If the market value of existing structures and land is lower because of the flood hazard, restoration of the market value represents a quantification of otherwise intangible benefits. In such cases, the benefit is the difference between increased market value and that portion of increased market value attributable to reductions in flood damages. Careful attention should be given to ensuring that factors not related to the flood hazard are not included as project benefits.[2]

e. No Projected Increase in Market Value. Projected increase in the market value of land over the project life with and without a plan should not be used to measure flood hazard reduction benefits because the current market value of land theoretically captures the expected stream of income over time.

6-43. Evaluation Procedure: Step 10--Compute NED Benefits. At this point in the analysis, enough information is available to compute NED benefits for structural and nonstructural measures. Table 6-6 displays the types of benefits claimable for three of the major flood hazard reduction measures and the steps in the procedure that provide the necessary data. The table applies generally; specific cases may vary. Discount and analyze all benefits at the appropriate discount rate to the beginning of the period of analysis. Benefits are categorized in the following way:

a. Inundation Reduction Benefits. To the extent that step 5 indicates that land use is the same with and without the project, the benefit is the difference in flood damages with and without the project (step 7), plus the reduction in flood proofing costs (step 8), plus the reduction in insurance overhead (step 8), plus the restoration of land values in certain circumstances (step 9) **[see above notation, para. 6-42d.]**. To the extent that step 5 indicates a difference in land use for an evacuation plan, the benefit is the reduction in externalized costs of floodplain occupancy that are typically borne by taxpayers or firms providing services to flood plain activities. Examples of such costs are subsidized flood insurance; casualty income tax deductions; flood emergency costs; and flood damages to utility, transportation, and communication systems. Reduction of costs not borne by the flood plain activities may be a major benefit of projects to evacuate or relocate flood plain activities. Reduction of flood damages borne by flood plain activities should not be claimed as a benefit of evacuation or relocation because they are already accounted for in the fair market value of flood plain properties. **[All damages avoided by flood mitigation measures are beneficial effects. Evacuation and relocation projects provide a special case for economic analysis because the effect of damage reductions are present in measures of both benefit and cost, therefore, double counting of this benefit must be carefully avoided. IWR Research Report 85-R-1, Assessment of the Economic Benefits from Flood Damage Mitigation by Relocation and Evacuation, provides a comprehensive discussion of NED benefit evaluation procedures for relocation and evacuation projects. In planning for, and evaluation of, relocation and evacuation projects considerable attention should be paid to the with project use of land which is to be evacuated, as the benefit, associated with such use may be crucial to project feasibility.]**

(1) Benefit from saving insurance costs. One category of costs that can be avoided by a removal plan is public compensation for private flood damages through the subsidized Federal Flood Insurance Program. Expressing savings in these externalized costs as project benefits is appropriate for properties in communities that participate in the Federal Flood Insurance Program or are expected to participate under the without project condition. This benefit is the reduction of insurable flood damages projected over the life of the project with careful attention to the projected without project condition.

Table 6-6
Guide to Types of Benefits

Type of Benefit (and step)	Structural	Floodproofing	Evacuation
Inundation:			
Incidental Flood damages (step 6)	Claimable	Claimable	Claimable
Primary Flood damages (step 6)	Claimable	Claimable	Not Claimable
Floodproofing cost reduced (step 7)	Claimable	Not Claimable	Not Claimable
Reduction in insurance overhead (step 7)	Claimable	Claimable	Claimable
Restoration of land value (step 9)	Claimable	Claimable	Not Claimable
Intensification (steps 7 and 9)	Claimable	Claimable	Not Claimable
Location:			
Difference in use (step 9)	Claimable	Claimable	Not Claimable
New use (step 9)	Not Claimable	Not Claimable	Claimable
Encumbered title (step 9)	Not Claimable	Not Claimable	Claimable
Open space (step 9)	Not Claimable	Not Claimable	Claimable

(2) Insurable flood damages. Base the projection of insurable flood damages on traditional depth-damage-frequency relationships used in projecting total flood damages. Then reduce projected total damages by subtracting: Losses that are noninsurable either because they are in noninsurance loss categories or because they exceed the coverage limits of the subsidized program; the deductible portion of each expected flood damage event; and the annual cost of the insurance premium paid by the policyholders. For this benefit calculation, assume that all eligible parties purchase subsidized insurance. This assumption is appropriate because the market value of properties, which determines project costs, reflects the availability of the program, not the extent of its utilization by current flood plain occupants.

b. Intensification Benefits. If step 5 indicates that land uses are the same with and without the project but activity is more intense with the project, measure the benefit as the increase in market value of land from step 9 or changes in direct income from step 6. Care must be taken to avoid double counting.

c. Location Benefits. If step 5 indicates that land use is different with and without the project, measure the benefit by the change in the net income or market value of the floodplain land and certain adjacent land where, for example, the plan creates open space (step 9).

6-44. Evaluation Procedure: Problems in Application. There are five major problem areas in computing flood hazard reduction benefits:

a. Income Losses. The loss of income by commercial, industrial, and other business firms is difficult to measure because of the complexity involved in determining whether the loss is recovered by the firm at another location or at a later time. Direct interview and empirical post-flood studies are the most appropriate data sources for analyzing whether a real resource loss, such as the idle capital or decaying inventories, is involved. The loss of income because of idle labor may be measured from the point of view of the firm or the household, but care must be taken to avoid double-counting. Loss of income because of idle labor must be net of income to labor employed in cleanup and repair of damages; unemployment compensation and other transfer payments to idle labor are not income from an NED perspective. **[Additional discussion of documentation requirements for lost net income and lost wages is provided in paragraph 6-46c.]**

b. Intensification Benefits. This category of benefits is theoretically applicable to urban situations, but there are to date few documented case studies. This benefit cannot exceed the increased flood damage potential when the existing activity is compared to the intensified activity (without the proposed plan).

[c. Location Benefits. This benefit cannot exceed the increased potential damages with the changed land use but without the project, or the costs of fill/flood proofing, whichever is less. The limitation applies to floodplain but not floodway land. The prohibition of development in floodways reduces land value by more than can be attributed to flood risk alone. That is, land value would have been higher in the absence of development prohibition. Thus, the lessor of limitation is not an upper bound on the increase in land value due to a flood control project since the project removes both the flood risk and the development restrictions. **See endnotes, Section 4, paragraph 6-31b.(3) for discussion of policy restrictions on location benefits.**]

d. Risk. The analysis of response to a flood hazard is based on a probability weighing of floods off various magnitude. This implies that flood plain occupants are risk-neutral, but many occupants, individually or as a group, either avert or accept risk. Therefore, responses to actual and potential flood damages should be viewed broadly in determining land use, mode of conducting business, and even benefits. Explain any significant deviations from expected behavior based on actual or potential flood damages computed on a risk-neutral basis.

e. Sensitivity Analyses. The report should contain sensitivity analyses that present a range of benefit levels representing data and assumptions about which reasonable persons might differ. Report the benefit level that is most probable; present other levels for public information. If increases in damages are based on increases in value, conduct a sensitivity analysis of value per structure under the alternate assumption that there is no increase in the average value of structure of contents and that increases in damages are due solely to increases in the number of structures and/or shifts from one type of structure to another. **[If explicit risk-based analysis has been used in the report, sensitivity analysis are not required. Sensitivity analyses could be performed as necessary to describe the sensitivity of the formulation to inherent assumptions.]**

f. Existing Levees that do not Meet Corps Criteria. Problems have often arisen in the benefit evaluation of flood damage reduction studies when there are existing levees of uncertain reliability. Specifically, the problem is one of engineering judgment but has implications for benefit evaluation: engineering opinion may differ or be uncertain on the ability of the levees to contain flows with water surface elevations of given heights. This may lead to difficulty in arriving at a clear, reasonable and agreed upon without project condition.

(1). General. Investigations for flood damage prevention involving the evaluation of the physical effectiveness of existing levees and the related effect on the economic analysis shall use a systematic approach to resolving indeterminate, or arguable, degrees of reliability. Reasonable technical investigations shall be pursued to establish the minimum and, to the extent possible, the maximum estimated levels of physical effectiveness. Necessary information and summary of analyses shall be included in report presentations of plan formulation and shall be documented in appropriate supporting materials.

(2). Sources of Uncertainty. Studies involving existing levees will focus on the sources of uncertainty (likely causes of failure). Other than overtopping, levees principally fail due to one or a combination of four causes: surface erosion, internal erosion (piping), underseepage, and slides within the levee embankment or foundation soils. Reasonable investigations, commensurate with the level of detail suitable to the planning activity underway, shall determine the condition of existing levees with respect to the factors that can lead to failure, if this information does not already exist.

(3). Performance Record. Existing levees either have or have not failed during previous flood events or have shown evidence of distress such as various degrees of piping, underseepage and sloughing. Information regarding their performance is relevant and vitally important in forming judgments regarding future performance. However, it should not be assumed that because a levee has passed a flood of a given frequency it will always do so in the future or vice versa, assuming the levee has been repaired.

(4).Reliability.

(a). Reliability judgments should be based solely on physical phenomena. The question to be answered is: what percent of the time will a given levee withstand water at height x? This means that considerations such as meeting FIA regulatory requirements, induced damages, induced flood heights, potential for increased risk of loss of life due to false sense of security, etc., are not included. These considerations will be dealt with separately during the plan formulation process.

(b). The purpose of the reliability determination is to be able to estimate the without-project damages. Its purpose is not to make statements about the degree of protection afforded by the existing levees. The preferred procedure is to estimate the reliability from the levee base to its top. As a minimum, information shall be gathered to enable the identification of two points on the existing levees. The first point is the highest vertical elevation on the levee such that it is highly likely that the levee would not fail if the water surface elevation were to reach this level. This point shall be referred to as the Probable Non-failure Point (PNP). The second point is the lowest vertical elevation on the levee such that it is highly likely that the levee would fail. This point shall be referred to as the Probable Failure Point (PFP). As used here, "highly likely" means 85+ percent confidence. As defined, the PNP will be at a lower elevation than the PFP. When there are unresolved uncertainties or differences of opinion,

consideration should be given to having the range of uncertainty extend from the lower of arguable PNPs to the higher of arguable PFPs. Because of lack of information or other reasons, if the PFP cannot be determined then the PFP shall be the low point in the levee where the levee is first overtopped. When determining the low point in the levee, assume that closure actions have taken place.

(c). Further technical guidance on reliability determinations is available in Engineering Technical Letter 1110-2-328, Reliability Assessments of Existing Levees for Benefit Determination, 22 March 1993.

(5). Benefit Evaluation Procedure. Even if no PNP is identified for an existing levee, it does, most likely, provide some benefits. Assessment of these benefits must be in some degree arbitrary in the absence of illuminating engineering or statistical analyses. The function of identifying the probable failure and non-failure points is to create a range of water surface elevations on the levee over which it may be presumed that the probability of levee failure increases as water height increases. The requirement that as the water surface height increases the probability of failure increases, incorporates the reasonable assumption that as the levee becomes more and more stressed it is more and more likely to fail. If duration information is known, explicit incorporation of the information is encouraged. If the form of the probability distribution is not known, a linear relationship is an acceptable approach for calculating the benefits associated with the existing levees. For benefit evaluation, assume all flood damages will be prevented below the PNP; and no damages will be prevented above the PFP.

6-45. Evaluation Procedure: Data Sources. The following summarizes problems associated with two key data sources:

a. Interviews. The primary use of personal interviews is to collect flood damage data, but interviews may also be used to collect other necessary data not available from secondary sources. Use only interview forms approved by the Office of Management and Budget. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in a way that protects the source of individual disclosures. Describe the errors and uncertainty inherent in the sampling methods and responses.

b. Local Land Use Plans. Local land use plans and zoning ordinances are valuable guides to future land use in the flood plain, but caution must be exercised in the use of such plans and ordinances. First, the demographic implications of local plans and ordinances must be consistent with, or convincingly distinguished from, trends in a larger area, e.g., OBERS. Second, a local plan is not an acceptable projection for the without project condition if it ignores the flood hazard. Third, the status, date, and likelihood of change of local plans vary. Finally, local plans may not contain sufficiently detailed information to be of direct use in benefit analysis.

[c. IWR Reports. Additional detailed support material for conducting NED evaluation for urban flood damage may be found in the following reference documents. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within these IWR reports.

(1) Urban Flood Damage (IWR Report 88-R-2, March 1988)--This manual provides an expanded description of urban flood damage reduction benefit procedures.

(2) Urban Flood Damage, Volume II, Primer for Surveying Flood Damage for Residential Structures and Contents (IWR Report 91-R-10, October, 1991)--This manual is a primer for conducting comprehensive flood damage and related surveys. It explains how basic principles of survey research can be applied to data collection for flood damage studies. Two prototype questionnaires (one in person and one mail with a preliminary telephone supplement) for collecting residential flood damage and related information are presented. Examples from previous applications of these questionnaires provide insight as to how they may be adapted and implemented for future flood damage studies.]

6-46. Urban Flood Damage - Additional Procedures.

a. Content Value. For feasibility studies, all content-to-structure ratios should be based on either site-specific surveys or surveys of comparable floodplains. In areas where surveys of comparable floodplains are used, at a minimum, qualitative rationale will be provided to demonstrate comparability of the survey to the study floodplain. Districts may request deviation from this guidance if they can reasonably demonstrate that lack of site specific content surveys will not effect plan formulation. Rationale for deviation from this guidance should be submitted to HQUSACE (CECW-PD) with accompanying Project Study Plan.

b. Depth-Damage Relationships. For feasibility studies, depth-damage relationships should be developed based on site-specific data or from comparable floodplain data. In areas where depth-damage relationships are based on comparable floodplain data, at a minimum, qualitative rationale will be provided to demonstrate the reasonableness of use of the depth-damage relationship in the study area. Districts may request deviation from this guidance if they can reasonably demonstrate lack of site-specific depth-damage relationships will not effect plan formulation. Rationale for deviation from this guidance should be submitted to HQUSACE (CECW-PD) with accompanying Project Study Plan. (Note that the Corps is developing generic depth-damage relationships through the Flood Damage Data Collection Program. The initial estimation of these curves is expected to be available in FY 98.)

c. Documentation requirements for location benefits. A location benefit is the increase in aggregate net income (increases less decreases) due to efficiencies of a flood plain location compared to the best non flood plain location. The P&G says estimated change in flood plain land price is an acceptable benefit measure, but care must be taken that decreases in price elsewhere are accounted for. Alternatively, when change in net income to the occupying activities is directly estimated, accounting for compensating changes in land prices is not relevant.

(1) Provide the following documentation in addition to that required by paragraphs 6-34 to 6-43.

(a) Document alternative sites for activities that might occupy the flood plain. Include sites which are available or would likely be available for development over the planning horizon, but which may not typically be included in a real estate study that focuses on comparable sales. There is usually substantial industrial/commercial land available in a typical urban area.

(b) Document specific characteristics of the protected flood plain which make it attractive in comparison to alternative non flood plain locations, such as availability of services, etc. Some idea of the likely nature of the occupying activity is required. Compare flood plain and non flood plain alternative locations on a characteristic by characteristic basis.

(c) Based on economic projections for the overall area, and on the potential for land use change in the overall area, allocate land use to flood plain and non flood plain locations in without and with

project conditions. The allocation must be explicitly based on the comparisons of subparagraph (b) above. Significant economic advantage of the flood plain location must be apparent as a basis for attributing predicted changes in land prices to locational advantage.

(d) If predicted changes in flood plain land values are to be the measure of benefits, the data and procedures by which the benefit estimate results from analysis of comparable sales must be documented.

(1) Choose comparable sales based on their similar characteristics to flood plain locations. These data are used in estimating NED benefits as discussed in paragraphs 6-42 and 6-43. Also, compare these sale prices to asking prices of non flood plain alternative locations identified in subparagraph (a) above. If alternative location asking prices are less, assess whether this means such sites would be preferable to floodplain sites. For example, if non flood plain asking prices are lower, it must be shown that flood plain site characteristics are sufficiently advantageous to outweigh the lower cost of non flood plain alternative sites.

(2) The spatial allocation and benefit estimates are supported when comparisons of both relative locational characteristics and relative land prices indicate flood plain locations are superior.

(e) If allocations are supportable by both comparisons of the locational characteristics and comparable sales data, it should be assumed that use of flood plain land is phased in as demand for additional land develops. Flood plain land should not be assumed to increase in value instantaneously.

(f) Adhere to policy in Policy Guidance Letter No. 25, Federal Participation in Land Development at Structural Flood Damage Reduction Projects and ER 1165-2-26, Implementation of Executive Order 11988 on Flood Plain Management. Alternative sites identified in paragraph b(1)(a) and b(1)(d)(l) above shall be used in determining the practicability of non flood plain locations. Policy Guidance Letter No. 25 is summarized as an end note to Section IV of this chapter.

(2) Required sensitivity on the reasonableness of benefits estimated by land value comparisons, and test of the non practicability of non flood plain locations.

(a) For representative activities estimate directly the change in net income that would accrue when a flood plain location is chosen over the best non flood plain location. Use these calculations to support benefits based on land value projections and for findings of non practicability of non flood plain locations.

(b) Estimate the increased damages which would accrue on the newly developable land in the flood plain if the development occurred in the without project condition.

c. Documentation requirements for lost net income and lost wages. The P&G allow income loss as an NED benefit only when it can be demonstrated that postponement or transfer does not occur. This is exceedingly difficult to demonstrate. If lost net income or lost wages is to be claimed as a benefit, an estimating procedure must be developed and submitted to HQUSACE CECW-PD for approval prior to inclusion of the benefits in feasibility reports or other decision documents. The PSP is an appropriate vehicle for documenting proposed procedures when it is desired to include lost income or lost wages benefits in feasibility studies.

d. Documentation requirements for savings in flooproofing costs on alluvial fans. Alluvial fans are triangular or fan shaped, gently sloping land forms which provide attractive development sites due to their commanding views. Alluvial fans primarily occur in the southwestern U.S. Active fans exhibit braided channels and erratic flowpaths that are typical of a young fan formation. These fans have severe flood hazards which exhibit unpredictable flow paths and high velocities that usually occur with little advance warning time. Flooding on the fan can cause considerable erosion in some areas and deposit large amounts of sediment and debris in other areas.

(1) The Federal Emergency Management Agency (FEMA) has provided guidance on techniques and strategies for minimizing losses from the flood hazards when building and developing on an alluvial fan (Alluvial Fans: Hazards and Management, May 1989) and additionally has placed restrictions on housing developments in Special Flood Hazard Areas (SFHA). The creation of an overall development master plan, drainage maintenance and floodplain management is encouraged by FEMA. The Federal Register dated March 7, 1989, 44 CFR states "topographic alterations alone, by fill or other means, will not serve as a basis for removing SFHA designations from alluvial fans." The procedures necessary for FEMA to recognize that a flood control measure is effective in removing or reducing the size of a SFHA on an alluvial fan have associated costs. To ensure that development projects are protected from alluvial fan flood hazards, FEMA's review criteria requires that the construction include elements which: do not cause the disturbance of natural flood processes on the fan; allow for safe collection, passage and disposal of flood related water, sediment and debris without negative impact to adjacent property; address erosion, scour, deposition, impact and hydrostatic forces; provide that the design and maintenance of project elements be coordinated with the local jurisdiction and/or agency responsible for flood control within the community.

(2) Cost associated with development compliance in accordance with FEMA alluvial fan regulations are NED costs where it can be demonstrated that these costs will occur in the without project condition. Removal of these costs through regional flood control solutions would therefore be an NED benefit. FOAs must, however, carefully document the without project condition. It can reasonably be expected that without project development will not occur in some areas of an alluvial fan because of prohibitively high compliance costs. This is likely true in the high velocity areas approaching the apex of the fan. In studies where alluvial fan compliance cost benefits constitute a major portion of total benefits, districts are required to quantitatively demonstrate that development will occur in the without project condition. An example of an appropriate quantitative analysis would be a comparison of developer costs and expected profits in project alluvial fan and non-alluvial fan areas. Additionally, districts must document historic floodproofing costs and explain any deviation from those projected for the benefit analysis.

6-4**7**. Report and Display Procedures. Include in the report enough data to enable the reviewer to follow the key steps above and, more important, the underlying rationale for the project.

a. Report Procedures For Risk and Uncertainty. To assist reviewers in assessing response to risk, summarize the following separately and display the information in tabular form:

(1) Remaining flood damage situations: Categorizations. The remaining damages are those expected to occur even with a flood plain management plan in operation. Remaining damages include:

(a) Damages to activities that would occupy the flood plain with as well as without the plan;

(b) Damages to activities that would occupy the flood plain only with the plan; and

(c) Increased damages to activities outside the protected area with and without the plan. This includes downstream flooding, if any, caused by the plan or project.

(2) Flood with two-tenths of 1 percent chance of occurrence. Fully describe the flood with two-tenths of 1 percent chance of occurrence (500-year frequency) with and without the plan. The report should contain, for example, two-tenths of 1 percent flood damages; the number of people and towns affected; the number of structures and acres by land-use type; disruption of essential services (e.g., water, power, fire protection, and sanitary services) and distance to unaffected essential services; anticipated warning time; flood depths, velocity, duration, debris content, etc.; and other indicators pertinent to catastrophic flooding. **[The .002 probability flood description will be based on the median probability discharge. If protection against the .002 probability event is recommended, the Standard Project Flood (SPF) shall also be analyzed and described, if it is larger than the .002 probability flood.]**

b. Summary Tables. Summary tables 6-7 through 6-10 are suggested presentations for all reports that include flood hazard reduction as a purpose. Other summary tables, such as the displays presented in paragraphs 6-34 through 6-44, may be necessary and pertinent. The summary tables should include pertinent land use data for computing not only NED benefits, but also environmental, social, and regional impacts. Also present other floodplain data pertinent to the evaluation on one or more maps: Flood limits and depths with and without the project; current and future land use; and 100-year and other flood limits and depths.

Table 6-7
Summary of Annualized NED Benefits and Costs
for Alternative Projects
(Applicable discount rate: _____)

Project benefits and costs	Alternatives			
	1	2	3	X
Flood hazard reduction benefits				
Inundation:				
Physical	.....	.....	.....	.....
Income	.....	.....	.....	.....
Emergency	.....	.....	.....	.....
Total	.....	.....	.....	.....
Intensification	.....	.....	.....	.....
Location:				
Floodplain	.....	.....	.....	.....
Off Floodplain	.....	.....	.....	.....
Total	.....	.....	.....	.....
Total flood benefits	.....	.....	.....	.....
Benefits from other purposes	.....	.....	.....	.....
Total project benefits	.....	.....	.....	.....
Project costs	.....	.....	.....	.....
Net benefits	.....	.....	.....	.....

Table 6-8
Flood Damages by Decade, Alternative Projects
(Applicable discount rate: ____)

Project	Time Period[1]			
	P0	P10	P20 etc	AAE [2]
No. 1	.....	.....	.....	.....
No. 2	.....	.....	.....	.....
No. 3	.....	.....	.....	.....

[1]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life
[2]Average annual equivalent

Table 6-9
Flood Damages in Decade Without Project
(Applicable discount rate: ____)

Property Type	Time Period[1]						
	P50	P40 etc	Existing	pn	P10	PN	AAE[2]
a (Subclassification of residential	.....	.....	.....	.....	.....	.....	.....
b	.....	.....	.....	.....	.....	.....	.....
c	.....	.....	.....	.....	.....	.....	.....
Commercial	.....	.....	.....	.....	.....	.....	.....
Industrial	.....	.....	.....	.....	.....	.....	.....
Other	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

[1]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life, P50 is 1932, P40 is 1942, etc.
[2]Average annual equivalent

Table 6-10
Number of Acres (or Structures),
Floodplain Without Project

Property Type	Existing	Time Period[1]						
		P0	P10	P20	P30	P40	P50	P100
a (Subclassification of residential units	.....	.....	.....	.....	.....	.....	.....	.....
b	.....	.....	.....	.....	.....	.....	.....	.....
c	.....	.....	.....	.....	.....	.....	.....	.....
Commercial	.....	.....	.....	.....	.....	.....	.....	.....
Industrial	.....	.....	.....	.....	.....	.....	.....	.....
Semipublic	.....	.....	.....	.....	.....	.....	.....	.....
Transportation	.....	.....	.....	.....	.....	.....	.....	.....

[1]Comparable tables may be made for all alternatives, if pertinent.
[2]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life

Section 4 Endnotes

SECTION V - NED BENEFIT EVALUATION PROCEDURES: POWER (HYDROPOWER)

6-4**8**. Purpose. This section describes procedures for the evaluation of national economic development (NED) benefits of hydropower features of water resources projects and plans. These features include single-purpose hydropower, the inclusion of hydropower as a function in new multipurpose projects, addition of power-generating facilities to existing water resource projects, and expansion of existing power plants. **[Guidance for major rehabilitation projects is provided in 6-165.]**

6-4**9**. Conceptual Basis.

a. The conceptual basis for evaluating the benefits from energy produced by hydroelectric power plants is society's willingness to pay for these outputs. If this is not possible or cost effective, benefit information may sometimes be obtained through examination of market prices. Although utility pricing of electricity is complex and usually based on average cost rather than marginal cost, in cases where it can be determined that market price to the final consumer is based on marginal production costs, this may be used as a measure of benefits. When using market price as a measure of benefits the increment in supply should ordinarily be relatively small compared to the total (i.e., little change would be expected in market price due to the incremental supply). Continued movement of retail electricity pricing towards marginal cost approximations (e.g., seasonal rates, time of day rates, etc.) may make market prices more relevant for benefit evaluation in the future. In the absence of such direct measures of marginal willingness to pay, the benefit from energy produced by hydroelectric powerplants is measured by the resource cost of the most likely alternative to be implemented in the absence of the alternatives under consideration. Non-Federal investment analysis generally does not provide an adequate basis for evaluation of potential investments of Federal resources in hydroelectric power. This is because non-Federal investments reflect financial conditions, insurance, and tax incentives that differ from those applying to Federal investments. The procedure that follows allows the planner to construct an NED benefit estimate based on real resource cost of the most likely non-Federal alternative. Simplifications are encouraged for small-scale hydropower projects. An alternative hydropower benefit evaluation procedure is provided for single-purpose projects that are to be 100 percent nonfederally financed, provided that there are no significant incidental costs.

b. The real resource cost of the most likely alternative can also be used to compute benefits from nonstructural measures. However, the net benefits of certain nonstructural measures that alter the electric power load cannot be measured effectively by the alternative cost procedures for the following reasons:

(1) Structural measures and many nonstructural measures (except those that alter the load) result in similar plan outputs, whereas load-altering measures (e.g., revised rate structures) may change levels of output; and,

(2) Load-altering measures may have fewer direct resource costs than measures based on higher levels of output. Because of this lack of comparability, the benefits from such load-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the benefits of load-altering nonstructural measures on the basis of direct willingness to pay are encouraged.

6-**50**. Planning Setting.

a. Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of a project, including any known changes in law or public policy. The without project condition includes the following specific assumptions:

(1) Existing resources. Existing generating resources are part of the without project condition. Make adjustments to account for anticipated plant retirements and changes in plant output due to age or environmental restrictions associated with existing policy and regulations.

(2) Existing institutional arrangements. Existing and reasonably expected future power system and water management contracts, treaties, and non-power river operating criteria are part of the without project condition. If revision of these arrangements is part of an alternative plan, the new arrangement (revised contract, criteria, etc.) would be considered in the with project condition.

(3) Alternative actions anticipated or under way. The without project condition includes those generating resources that can reasonable be expected to be available in the forecast period.

(4) Nonstructural measures and conservation. The without project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures.

b. With Project Condition.

(1) The with project condition is the most likely condition expected to exist in the future with the plan under consideration. Examples of alternative plans include: alternative combinations of projects in a basin study; alternative sites in a reach study; alternative plant sizes at a specific site; alternative reservoir sizes at a reservoir site; use of reregulation and/or pumpback to increase firm capacity; and reallocation of storage to increase firm energy output.

(2) Nonstructural alternatives to hydropower may be used alone or in combination with structural measures. Nonstructural measures include by**(but)** are not limited to reducing the level and/or time pattern of demand by time-of-day pricing; utility-sponsored loans for insulation; appliance efficiency standards; education programs; inter-regional power transfers; and increased transmission efficiency.

6-5**1**. Evaluation Procedure: General.

a. Follow these steps (See Figure 6-4) to estimate NED benefits that would accrue whenever the plan would not be 100 percent nonfederally financed. When single-purpose hydropower alternatives being studied would be 100 percent nonfederally financed, the market-based procedure specified in paragraph 6-56 may be used. Nonfederally financed means that all construction and operating costs would be financed entirely from sources other than federally appropriated funds. The level of effort expended on each step depends upon the nature of the proposed development, the state of the art for accurately refining the estimate, and the likely effect of further refinement on project formulation and justification.

b. For the purpose of ensuring efficiency in the use of planning resources, simplifications of the procedures set forth in this section are encouraged in the case of single-purpose, small scale hydropower projects (25 MW or less), if these simplifications lead to reasonable approximations of

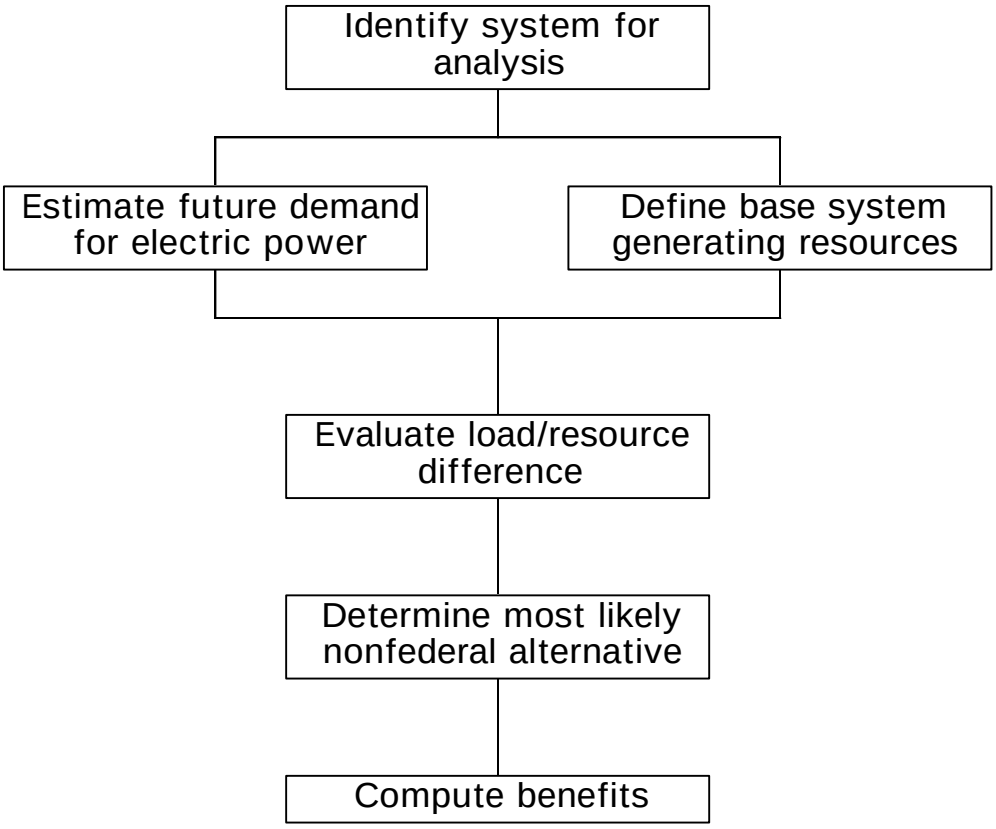


Figure 6-4. Flowchart of Hydropower Benefit Evaluation Procedures

NED benefits and costs. In addition, an analysis of marketability may be substituted for determination of need for future generation for hydropower projects up to 80 MW at existing Federal facilities.

6-5**2**. Evaluation Procedure: Identify System For Analysis. Because of the trend toward interconnection and coordination among utilities and power systems, it is most appropriate to evaluate NED benefits for hydropower on a system basis, rather than on the needs of an individual utility or local area. The size of the system would depend on the situation but could consist of a power pool, a National Electric Reliability Council (NERC) regional area, the marketing area of a Federal power marketing administration, or other geographic region. In some cases, physical or institutional constraints may limit the analysis to a smaller area, but care must be taken to ensure that benefits are not misstated by such analysis.

6-5**3**. Evaluation Procedure: Determine Need For Future Generation.

a. Estimate Future Demand For Electric Power. Forecast electric power loads in terms of the annual peak demand period. When a high proportion of the generation is from hydropower, a forecast of annual energy demand should be made. Also forecast weekly load shapes to represent a minimum of three periods in the year (e.g., typical summer, winter, and spring/fall days) to assist in determining the type of load that a hydropower project could carry. Load forecasts should reflect the effects of all load management and conservation measures that, on the basis of present and future public and private programs, can reasonably be expected to be implemented during the forecast period. Load forecasts should be made and analyzed by sectoral use (e.g., residential, commercial, industrial). Estimate loads at increments of no more than 10 years from the present to a time when the proposed plant will be operating in a state representative of the majority of its project life. In the case of staged hydropower development or where generation system resource mixes may change markedly, load forecasts may be appropriate for 20 years or more beyond the initial operation date. Account for system exports and reserve requirements.

b. Define Base System Generating Resources. Project future generating resources and imports at various points in time without the proposed plan or any alternative plan. Estimate resources for the time periods stated in paragraph 6-5**3**a. Provide information on peak capacity and on average annual energy production where a high proportion of the systems generation is hydropower. Data are readily available on projected system resources for about 10 years. Base projected resource additions beyond that time on system studies. Account for retirement of older plants as well as the reduction of output of some plants due to age or environmental constraints.

c. Evaluate Load/Resource Difference. Compare the loads identified under paragraph 6-5**3**a with the resources identified under paragraph 6-5**3**b to determine: (1) when generating resource deficits will occur, (2) the magnitude of these deficits, and (3) what portion of these deficits could be met by the hydropower project. If nonstructural measures are components of an alternative plan and these measures reduce system loads, the amount of such reduction lessens system deficits. Hydropower sites can be developed to provide either a base load, mid-range, or peaking service. Evaluate the system demand for each class of hydropower generation. Simple tabulation of annual peak and energy loads and resources is generally adequate for preliminary studies. Use system load-resource models that account for load characteristics and generating plant operating capabilities, if available, to evaluate accurately the usability of specific projects.

6-5**4**. Evaluation Procedure: Determine the Most Likely Non-federal Alternative.

a. General. Select the one alternative most likely to be implemented in the absence of the proposed Federal project. Begin identification of the most likely alternative to the plan being considered

with the least costly alternative. If an alternative with a lesser cost is passed over for a more expensive one, justify not selecting the lower cost plan.

b. Screen Alternatives. The alternatives to a specific hydropower project must be viable in terms of engineering, environmental quality, and other national policy considerations. Engineering viability limits thermal alternatives to commercially available electric powerplants. Environmental viability implies that plant costs include all equipment required to meet environmental quality criteria. National policy considerations include factors such as legal limitations on the use of oil, natural gas, and other "scarce" fuels for electric power generation. Each alternative need not in itself deliver service similar in kind to the hydropower project, but the total power system with the alternative must deliver service similar in kind to the system with the hydropower project. If nonstructural measures or conservation are components of an alternative plan and these measures reduce the need for additional capacity or for additional power, the amount of such reduction constitutes provision of service similar in kind; this ensures that evaluation procedures will not be biased against the selection of an alternative that utilizes nonstructural measures.

c. Identify the Most Likely Alternative.

(1) Compare the system with the hydropower project under consideration to alternatives capable of meeting system loads within established criteria of system reliability. Base the comparison on the basis of cost and other factors to determine the most likely alternative, i.e., the structural and/or nonstructural measures that will be implemented if the project under consideration is not implemented.

(2) If institutional obstacles to implementation are noted, an alternative plan should still be considered the most likely if the barriers are substantially within the power of the affected users to correct. A detailed description of the institutional obstacles should be included, with a discussion of the basis for the conclusion that the obstacles cannot be overcome.

(3) If the most likely alternative includes new thermal plants, use those plants' capacity costs (including amortized investment costs, transmission costs and fixed operating and maintenance (O&M) costs) as the measure of the value of the hydropower project's generating capacity, and use the thermal plants' energy costs (primary variable O&M costs and fuel costs) as the measure of the value of the hydropower project's energy production.

6-5**5**. Evaluation Procedure: Compute Benefits.

a. Compute Hydropower Plant Annual Benefits. Compute annualized benefits based on the costs of the most likely alternative for each hydropower development and installation component.

(1) Alternative costs.

(a) Base the calculation of alternative costs to be used as a measure of NED benefits on the following: (i) calculate all interest and amortization costs charged to the alternative on the basis of the Federal discount rate; (ii) charge no costs for taxes or insurance to the alternative; and (iii) in calculating costs of the most likely alternative, use assumptions and procedures that parallel those used to calculate the costs of the plan being evaluated.

(b) In many cases, benefits may vary over the life of a project. This may be due to such factors as staged development of the hydropower project, changes in operating of the hydropower project resulting from changes in the resource mix in the total generating system, and real escalation in fuel costs (if the most likely alternative system includes a thermal plant). Compute project benefits by time intervals and discount these values to derive annualized power benefits.

(c) When applicable, the evaluation shall reflect differences in the cost of transmission, distribution, and other facilities compared to the most likely alternative.

(d) Occasionally, the initial output of a hydropower project is large compared to annual growth in system load; two or more years may be required to fully absorb its output into the load. In these cases adjust the credit (benefit) to reflect the generating capacity and energy actually used in the load in the early years of project life.

(2) Energy value adjustment. Account for the effect on the system production expenses when computing the value of hydroelectric power. Adding structural or nonstructural measures of a plan to a system instead of adding an alternative power source may result in greater or lesser system production expenses than if a particular thermal capacity were added; the effect on production expenses can be determined by performing a system analysis. If there is a difference in system production expenses, adjust the energy value in the economic analysis of the plan. If the alternative plan would increase system production expenses, the adjustment would be positive. Consider system production expenses in determining the most likely alternative.

(3) Capacity value adjustment. The physical operating characteristics of hydropower projects differ significantly from alternative thermal plants. Appropriate credit may be given to hydropower projects to reflect their greater reliability and operating flexibility. When the value of these characteristics cannot otherwise be quantified, an adjustment can be made to the alternative plant capacity costs. Typically, the adjustment per kilowatt of capacity ranges from 5 to 10 percent of the cost per kilowatt of thermal capacity, depending on the operating characteristics of the hydropower project and alternatives that include thermal capacity. The adjustment may be applied by increasing the capacity cost of the most likely alternative by the appropriate percentage determined by the Federal Energy Regulatory Commission (FERC).

(4) Intermittent capacity adjustment. The dependable capacity of hydropower project is based on the load-carrying capacity of the project under the most adverse combination of system loads, hydrologic conditions, and plant capabilities. This very conservative approach is unrelated to the dependable capacity of a hydropower project's alternative if thermal capacity is included and given no credit for the value of capacity that is available a substantial amount of the time. When power system operation studies show that there is an intermittent capacity value to the system, a capacity adjustment should be made.

(5) Price relationships. Assume relative price relationships and the general level of prices prevailing during the planning study to hold generally for the future, unless specified studies and considerations indicate otherwise. Examples of the latter include escalation of relative fuel cost (e.g., due to increasing scarcity) or increased capital costs expected to result from changed environmental or safety criteria. Fuel costs used in the analysis should reflect economic prices (market clearing) rather than regulated prices.

b. Compute Benefits of Nonstructural Measures. Compute the average annual benefits of nonstructural measures, based on the cost of the most likely alternative identified above, except as specified in paragraph 6-48b.

6-5**6**. Evaluation Procedure: Data Sources. Data on existing and planned resources, loads, marketability criteria, and alternative costs are available from various agencies and groups, including the Department of Energy, NERC regional councils, FERC regional offices, Federal power marketing administrations, State energy agencies, utility companies, and regional planning groups. If specific operating characteristics of individual plants are not available, generalized data can be obtained from other sources, including the Electric Power Research Institute. Load-resources models based on

simulated system operation may be used if available. Some of these models are available from various sources, including FERC, Federal power marketing administrations, and a number of consulting services.

6-5**7.** Alternative Procedure: Financial Evaluation.

a. General. This section provides an alternative hydropower benefit evaluation procedure that may be used for evaluating single-purpose projects that are to be 100 percent nonfederally financed, provided that there are no significant incidental costs. This approach employs market data based on long-run (10 or more years) utility wholesale prices as an estimate of the cost of producing equivalent power from the most likely alternative. These prices may be used to evaluate and compare the financial feasibility of alternative plans, provided that they are consistently applied to all of the alternatives. The formulation of alternative plans under this procedure is subject to the provisions of Chapter 5, Section I, including evaluation of incidental benefits and costs, compliance with environmental laws, and inclusion of appropriate mitigation. Through this process, the most financially attractive alternative is identified. Because the benefits and costs of all alternative plans are evaluated in a consistent way, the most financially attractive plan can be identified as the NED plan.

b. Industry Long-run Wholesale Prices. The market approach must be carefully applied to ensure that the long-term (10 or more years) contract prices reflect the energy and capacity characteristics of the proposed hydropower project. In screening contracts for applicability, a number of factors should be examined, including: term of contract, power and energy availability (daily, weekly, seasonally), geographic relationship, delivery voltage, power factor, point(s) of delivery (busbar, high voltage grid, load center), interconnecting facilities, reliability standards and emergency backup. Information on long-term wholesale power contracts may be obtained from the Federal Energy Regulatory Commission, State public service commissions, the Federal power marketing administrations, and electric generating and distribution utilities.

6-5**8**. Report and Display Procedures.

a. Tables 6-11 through 6-13 are suggested for presentation for reports that include federally financed hydropower measures. Table 6-11 summarizes the output of all plans by peaking capacity and system load factor, and presents the costs of each alternative plan. Tables 6-12 and 6-13 summarize the output of the structural component of each alternative, the benefits of the structural components, and the resource costs of all structural and nonstructural components of each alternative plan. The number of benefit categories included will carry from project to project. Not all projects will have intermittent capacity, for example, and in some cases it will be appropriate to account separately for firm and secondary energy. System energy costs are sometimes included in the unit energy values; in those cases such costs would not have to be accounted for separately.

b. Table 6-13 is suggested if the nature or magnitude of hydropower benefits changes substantially over time. Examples are: staged construction of the hydropower project; change in the role of hydropower in the system over time; and situations in which several years are required to absorb a large project into the system.

c. When the alternative financial evaluation procedure is used to evaluate financial feasibility of plans that are to be 100 percent non-Federally financed (see paragraph 6-56), physical data similar to that found in Tables 6-11 through 6-13 should be displayed. Capacity and energy values, as developed through the financial analysis, should also be displayed in a manner facilitating comparison among alternatives. These displays are in lieu of the standard presentation of hydropower benefits and project costs in the NED account. Also display any incidental benefits and costs of the alternatives. However, no benefit-cost ratio can be presented, because the analysis of the hydropower project's financial feasibility is not comparable to economic analysis.

Table 6-11
Electric Power Supply Alternatives
[Period of analysis, price level, discount rate]

	Annualized cost[1] ($1,000)	Peak power supplied conserved, and system load factor (MW)[2] by time period[3]			
		P_1	P_2	P_3	P_N
Most likely alternative	.....	.....	.....	.....	.....
Recommended plan.....	.....	.....	.....	.....	.....
Other plans analyzed.....	.....	.....	.....	.....	.....

[1]Annual equivalent cost includes system costs.
[2]For example, for the summer season, an entry "90 10 .6" would represent the 100 MW deficit in the summer peak use identified in the without-project condition by supplying 90 MW and reducing the quantity used by 10 MW; the system load factor for the entire system for the summer would be .6.
[3]Show by time period and season where there are seasonal variations

Table 6-12
Summary of Annualized NED Benefits for Structural
Measures and NED Costs for Structural and Nonstructural Measures[1]
[(Thousands of month, year dollars) Applicable discount rate: ____]

	Alternative			
	1	2	3	X
Plant data:				
Installed capacity, MW	.....	.....	.....	.....
Dependable capacity, MW	.....	.....	.....	.....
Intermittent capacity, MW	.....	.....	.....	.....
Average annual energy, gWh	.....	.....	.....	.....
Average annual capacity factor (percent).....	.....	.....	.....	.....
Benefits:				
Unit capacity	(.....)	(.....)	(.....)	(.....)
Dependable capacity benefits.....	.....	.....	.....	.....
Intermittent capacity benefits.....	.....	.....	.....	.....
Unit energy value (mills/kWh).....	(.....)	(.....)	(.....)	
Energy benefits.....	.....	.....	.....	.....
Unit system energy adjustment (mills/kWh)	(.....)	(.....)	(.....)	(.....)
System energy cost adjustment	.....	.....	.....	.....
Real fuel cost escalation rate (percent).....	(.....)	(.....)	(.....)	(.....)
Period of real fuel cost adjustment (yrs).....	(.....)	(.....)	(.....)	(.....)
Real fuel cost adjustment	.....	.....	.....	.....
Total hydro benefits.....	.....	.....	.....	.....
Other purpose benefits (list).....	.....	.....	.....	.....
Annualized cost	.....	.....	.....	.....
Structural measures	.....	.....	.....	.....
Nonstructural measures.....	.....	.....	.....	.....
Net annualized benefits	.....	.....	.....	.....

[1]Note that benefits from load-altering nonstructural measures are excluded. This table may be used for displaying the benefits of nonstructural measures that do not alter the load (see 2.5.2(b)).

Table 6-13
Time Distribution of NED Electric Power Benefits
for Structural Measures of Alternatives[1]
(Applicable discount rate: ___)

	Alternative				
	P_1	P_2	P_3	P_x	AAE[3]
Plant data:					
Installed capacity, MW	.....	.....	.....	.....	.....
Dependable capacity, MW	.....	.....	.....	.....	.....
Intermittent capacity, MW	.....	.....	.....	.....	.....
Average annual energy, gWh	.....	.....	.....	.....	.....
Average annual capacity factor (percent)	.....	.....	.....	.....	.....
Benefits:					
Unit capacity	(.....)	(.....)	(.....)	(.....)	(.....)
Dependable capacity benefits	.....	.....	.....	.....	.....
Intermittent capacity benefits	.....	.....	.....	.....	.....
Unit energy value (mills/kWh)	(.....)	(.....)	(.....)	(.....)	(.....)
Energy benefits	.....	.....	.....	.....	.....
Unit system energy adjustment (mills/kWh)	(.....)	(.....)	(.....)	(.....)	(.....)
System energy cost adjustment	.....	.....	.....	.....	.....
Real fuel cost escalation rate (percent)	(.....)	(.....)	(.....)	(.....)	(.....)
Period of real fuel cost adjustment (yrs)	(.....)	(.....)	(.....)	(.....)	(.....)
Real fuel cost adjustment	.....	.....	.....	.....	.....
Annualized benefits	.....	.....	.....	.....	.....

[1]Note that benefits from load-altering nonstructural measures are excluded. This table may be used for displaying the benefits of nonstructural measures that do not alter the load (See paragraph 6-48b)
[2]Time periods selected depend on nature of project and power system.
[3]Average annual equivalent.

SECTION VI - NED BENEFIT EVALUATION PROCEDURES: TRANSPORTATION INLAND NAVIGATION

6-5**9**. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the inland navigation features of water resource projects and plans. **[Guidance for major rehabilitation projects is provided in paragraph 6-165.]**

6-**60**. Conceptual Basis. The basic economic benefit of a navigation project is the reduction in the value of resources required to transport commodities. Navigation benefits can be categorized as follows:

a. Cost Reduction Benefit (same origin-destination; same mode). For traffic that uses a waterway both with and without a project, the benefit is the reduction in the economic cost of using the waterway. This reduction represents an economic efficiency or NED gain because resources will be released for productive use elsewhere in the economy; for example:

(1) Reductions in costs incurred from trip delays (e.g., reduced congestion by expanding lock sizes at congested facilities or by imposition of congestion fees).

(2) Reduction in costs because larger or longer tows can use the waterway (e.g., by channel straightening or widening).

(3) Reduction in costs by permitting barges to be more fully loaded (e.g., by channel deepening).

b. Shift of Mode Benefit (same origin-destination; different mode). For traffic that would use a waterway with the project but uses a different mode, including a different waterway, without the project, the benefit is the difference between the costs of using the alternative mode without the project and the costs of using the waterway with the alternatives under consideration. The economic benefit of the waterway to the national economy is the savings in resources from not having to use a more costly mode.

c. Shift of Origin-destination Benefit. If a project would result in a shift in the origin of a commodity, the benefit is the difference in total costs of getting the commodity to its place of use with and without the project. If a project would result in a shift in the destination of a commodity, the benefit is the difference in net revenue to the producer with and without the project. The shift of origin-destination benefit cannot exceed the reduction in transportation charges achieved by the project.

d. New Movement Benefit. This benefit applies if a commodity or additional quantities of a commodity would be transported only because of lowered transportation charge with the project. The quantities are limited to increases in production and consumption resulting from lower transportation costs. An increase in waterway shipments resulting from a shift in origin or destination is not included. The new movement benefit is defined as the increase in producer and consumer surplus; practically, it can be measured as the delivered price of the commodity less all associated economic costs, including all of the costs of barge transportation other than those of the navigation project. This benefit, like the preceding one, cannot exceed the reduction in transportation costs achieved by the project.

e. Use of Rates For Benefit Measurement. It is currently more difficult to accurately compute the long-run marginal costs of particular rail movements on the basis of cost estimation studies than to determine the rates at which railroad traffic actually moves. In competitive markets, rates (prices) correspond to marginal cost, and, given market stability, prices will settle at long-run marginal costs. Moreover, the rates actually charged determine the distribution of traffic among modes. Fore these

reasons, rates will be used to measure shift of mode benefits. Section 7a of the Department of Transportation (DOT) Act of 1966 (Public Law 89-670) requires the use of prevailing rates, as described in paragraph 6-6**7**b. In the case of new waterways, this rate may or may not represent the best estimate of long-run marginal costs. In the case of existing waterways, prevailing competitive similar rates are the best available approximation of long-run marginal costs.

[f. Risk-based Analysis Procedure. Institute of Water Resources and HQUSACE staff are currently in the process of developing risk-based analysis procedures for inland navigation studies. Although these efforts are ongoing, preliminary indications are the following variables should be explicitly incorporated in risk-based analysis; 1) commodity forecasts, 2) alternative mode costs, 3) reliability of existing and proposed structures, and, 4) system delays associated with capacity constraints. Additional variables can be incorporated if appropriate for individual study areas. Districts are expected to incorporate risk-based analysis procedures in all inland navigation studies. Until risk-based procedures are fully developed, districts are expected to, at a minimum, perform sensitivity analysis of key variables.]

6-6**1**. Planning Setting.

a. Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of the navigation project or any change in law or public policy. The without project condition includes any practice likely to be adopted in the private sector under existing law and policy, as well as actions that are part of broader private and public planning to alleviate transportation problems. The following specific assumptions are part of the projected without project condition:

(1) Assume that all reasonably expected nonstructural practices within the discretion of the operating agency, including helper boats and lock operating policies, are implemented at the appropriate time. Substantial analysis is required to determine the best combination of nonstructural measures to ensure the most effective use of an existing waterway system over time. This analysis should be documented in project reports to assure the reviewer that the best use of existing facilities will be made in the without-project condition and that the benefits of alternative with project conditions are correctly stated. The criteria for the best utilization of the system are overall public interest concerns, including economic efficiency, safety and environmental impact.

(2) User charges and/or taxes required by law are part of the without project condition. Proposed or possible fees, charges, or taxes are not part of the without project condition but should be considered as part of any nonstructural alternatives in the with project condition.

(3) The without project condition assumes that normal operation and maintenance will be performed on the waterway system over the period of analysis.

(4) In projecting traffic movements on other modes (railroad, highway, pipeline, or other), the without project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary.

(5) Alternative modes should be analyzed as a basis for identifying the most likely route by which commodities will be transported in the future in the absence of waterway improvement.

(6) The without project condition normally assumes that only waterway investments currently in place or under construction are in place over the period of analysis.

b. With Project Condition. The with project condition is the most likely condition expected to exist in the future if a project is undertake. The same assumptions as for without project condition

underlie the with project condition. The following discussion relates to the alternatives considered under the with project condition.

(1) Management of demand by the use of congestion or lockage fees is a nonstructural alternative, which alone or in combination with structural devices may produce an economic optimum in a congested waterway. Influencing marginal waterway users through a congestion fee can increase the net benefits of a waterway. Evaluate alternatives that influence demand on the same basis as supply-increasing (structural) alternatives. **Because lockage time is a scarce commodity, the imposition of a congestion fee will work to allocate this commodity in an efficient manner. HQUSACE (CECW-PD) should be consulted for assistance in analyzing congestion fees.**

(2) Additional nonstructural measures not within the current purview of the operating agency may be considered "supply management" measures. One example is traffic management. These supply-increasing (nonstructural) measures can be used alone or in combination with other structural or nonstructural measures.

(3) Project alternatives can differ in their timing as well as in their physical characteristics. Consider the optimal timing of projects and of individual project features in project formulation, so as to maximize net benefits over time.

(4) Consider improvements in alternative transportation modes as part of the without project condition only, as specified in paragraph 6-6**1**a(5).

(5) A change in the waterway system that is currently authorized by**(but)** not yet under construction may be included if an appropriate share of its associated costs is included in the costs of the alternative under study and its incremental contribution to benefits is explicitly identified.

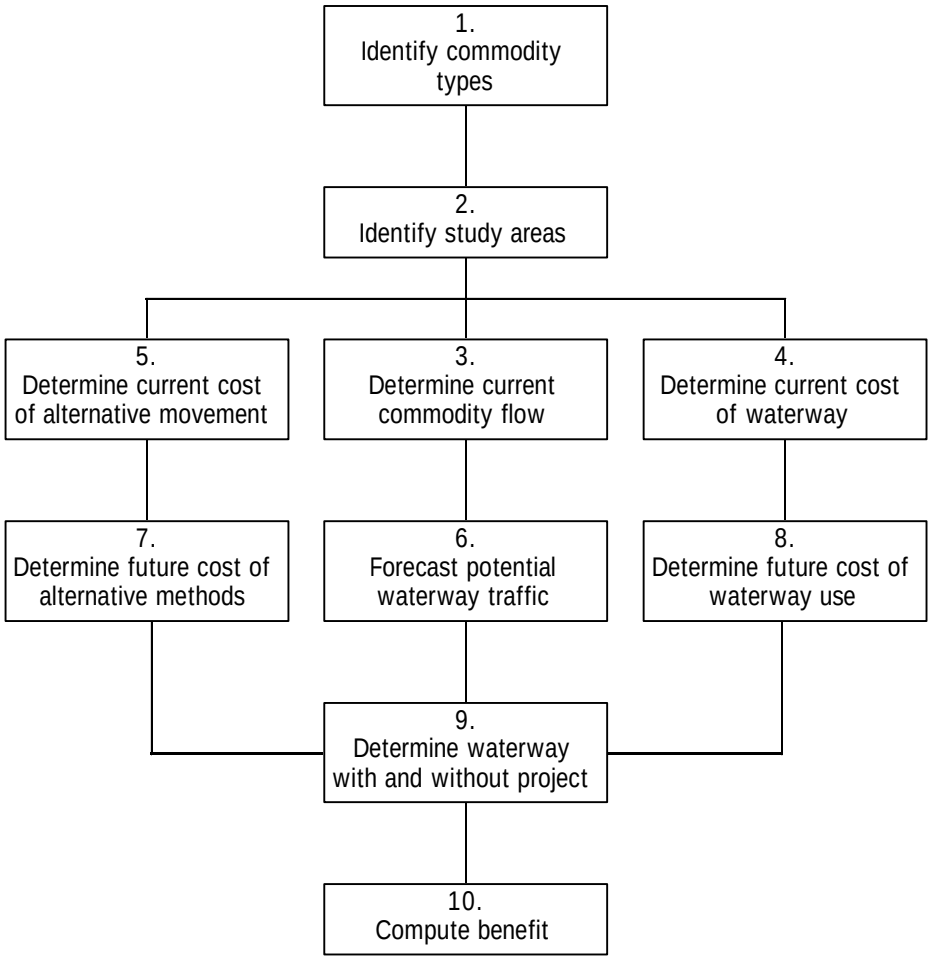
6-6**2**. Evaluation Procedure: General. Use the following 10 steps to estimate navigation benefits. (See Figure 6-5) The level of effort expended on each step depends upon the nature of the proposed improvement, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to further refinement, especially as applied to steps 6,7, and 8.

6-6**3**. Evaluation Procedure: Step 1--Identify the Commodity Types. Identify the types of commodities susceptible to movement on the waterway segment under consideration. The level of detail for each commodity is not prespecified; for example, in some cases "grains" is detailed enough, while others, "corn," "wheat" or "soybeans" is needed.

a. New Waterways. Identify commodity types primarily by interviews of shippers and by resource studies. Interviews will identify primarily the benefit potentials of a shift of mode; resource studies will identify primarily the benefit potentials of shifts in origin-destination and in new movements.

b. Existing Waterways. Identify commodity types primarily by analysis of data on existing use of the waterway segment under study; e.g., data from the Performance Monitoring System (PMS) and the Waterborne Commerce Statistical Center (WCSC).

6-6**4**. Evaluation Procedure: Step 2--Identify the Study Area. The study area is the area within which significant project impacts are incurred. The origins and destinations of products likely to use the waterway are normally included in the study area, broken out by river segments.


1.
Identify commodity types
2.
Identify study areas
5.
Determine current cost of alternative movement
3.
Determine current commodity flow
4.
Determine current cost of waterway
7.
Determine future cost of alternative methods
6.
Forecast potential waterway traffic
8.
Determine future cost of waterway use
9.
Determine waterway with and without project
10.
Compute benefit

a. New Waterways. Determine the origins and destinations primarily by interviews of shippers and by resource studies.

b. Existing Waterways. Determine origins and destinations by analysis of data on existing use of the waterway segment under study; e.g., PMS and **(W)**CSC traffic traced to its ultimate origin and destination.

6-6**5**. Evaluation Procedure: Step 3--Determine Current Commodity Flow. Gather current data for commodity movements between origin-destination pairs susceptible to waterway movement as well as for commodities currently transported by waterway.

a. New Waterways. This step seeks to identify the total tonnage that could benefit from using the waterway. Obtain this information primarily by interviews of shippers. For benefits from shifts in origin and destination and from new movements, care must be taken to identify whether such movement would be likely to occur if waterway transportation were available; base this information primarily on interviews. Give particular attention to delivered price from substitute sources in the case of benefits from shifts in origin and destination, and to resource and market analysis in the case of benefits from new movements. Assess current transportation costs in the area.

b. Existing Waterways. This step seeks to identify uses beyond the existing use of the waterway; it seeks to identify potential commodities that might use the waterway in response to a reduced transportation charge.

6-6**6**. Evaluation Procedure: Step 4--Determine Current Costs of Waterway Use. Determine current costs of waterway use for all the tonnage identified in step 3. Include in the waterway transportation cost the full origin-to-destination costs, including handling, transfer, demurrage, and prior and subsequent hauls for the tonnages identified in step 3. Consider the effect of seasonable **(seasonality)** on costs. In calculating the cost of prior and subsequent hauls, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which there is a wide geographic dispersion in ultimate origins and/or destinations, as in the case of grain traffic.

a. New Waterways. The current cost of the proposed waterway use represents the with project condition; there are not**(no)** without project costs for waterway transportation.

b. Existing Waterways. Construct two arrays, one representing the without project and one the with project condition. The difference between the two arrays reflects the reduction in current delays and any gains in efficiencies resulting from the alternative under consideration.

6-6**7**. Evaluation Procedure: Step 5--Determine Current Cost of Alternative Movement. Determine the current cost of alternative movement for all the tonnages identified in step 3. The cost includes the full origin-to-destination costs, including costs of handling, transfer, demurrage, and prior and subsequent hauls. Consider the effect of seasonality on costs. In calculating the costs of gathering or distribution prior or subsequent to the primary line haul, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which the ultimate origins and/or destinations are widely dispersed, as the case of grain traffic. This procedure uses price data when available as a proxy for the long-run costs of movement by other modes. This step, combined with steps 3 and 4, generates a first approximation of the demand schedule for waterway transportation given (1) the costs of transportation by alternative modes, (2) current levels of production, and (3) the distribution of economic activity.

a. New Waterways. In the case of rail movements, use the prevailing rate actually charged for moving the traffic to be diverted to waterways. For traffic induced by the waterway construct the rail rate as in step 5b.

b. Existing Waterways. Use rate and other price data when available to estimate the cost of movement by alternative modes. In the case of rail movements, if the rate for that movement is not now used, use prevailing rates that are (1) competitive, and (2) for movements similar to the individual move that would occur without the project. Avoid the use of paper rates, i.e., rates at which no significant amount of traffic is actually moved. A rate is "competitive" to the extent that it is for traffic for which there is intra modal or intermodal competition within the relevant markets. In identifying a "similar" movement, the factors considered may include geographic location, degree of use, characteristics of terrain, backhaul, contract division, seasonality, ownership of rolling stock, and physical rail connection to the shipper. It is the responsibility of the analyst to select rates that, in his or her view, best represent the long-run marginal costs of the movement. Cost estimates for particular movements may be useful in selecting the rate or rates that best meet the criteria of competitiveness and similarity. If more than one competitive and similar rate is identified, an average may be used. Assume that all water-compelled or water-competitive rates are competitive and similar.

6-6**8**. Evaluation Procedure: Step 6--Forecast Potential Waterway Traffic by Commodity. Develop projects of the potential use of the waterway under study for selected years from the time of the study until the end of the project life, over time intervals not to exceed 10 years. Document commodity projects for the commodity groups identified in step 3.

a. The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and the availability of data and previous studies.

b. Generally, OBERS projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of OBERS-derived indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by OBERS. Even when total commodity flows can be adequately described through the use of indices derived from OBERS projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by OBERS.

c. If problems of the type described in paragraph b. above are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data with (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts; and (3) historical flow patterns. Commodity projections can then be constructed on the basis of the results of the independent studies.

d. Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life through the use of general indices on a regional and industry basis. Such indices can be constructed from the OBERS projections or other generally accepted multi-industry and regional models.

6-6**9.** Evaluation Procedure: Step 7--Determine Future Cost of Alternative Modes.

a. Future cost per unit of each commodity will normally be the same as current cost. As stated in paragraph 6-6**1**a(5), the without-project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary. This step combined with step 6 provides a time series of demand schedules specific to a particular commodity origin-destination pattern. Address the projection of any change in future prices as indicated below.

b. A future rate is a prevailing rate as defined in step 5. It reflects exclusively a shift in rates because of projected changes in the volume of shipments on a given mode or a shift from one mode to another (e.g., from rail to pipeline). To support such a shift, show that the increase in volume is likely to lead to a change in rate; do not assume, for example, that an increase in volume of traffic of a commodity from one area to another will automatically ensure a more favorable high-volume rate.

6-**70.** Evaluation Procedure: Step 8--Determine Future Cost of Waterway Use. Two separate analyses make up this step. First, analyze the possibility of changes in the costs of the waterway mode for future years for individual origin-destination commodity combinations. Second, analyze the relationship between waterway traffic volume and system delay. Do this second analysis in the context of the total volume of traffic on the waterway segments being studied for with and without project conditions. This analysis will generate data on the relationship between total traffic volume and delay patterns as functions of the mix of traffic on the waterway; it may be undertaken iteratively with step 9 to produce a "best estimate."

6-7**1**. Evaluation Procedure: Step 9--Determine Waterway Use, With and Without Project. At this point the analyst will have a list of commodities that potentially might use the waterway segment under study, the tonnages associated with each commodity, and the costs of using alternate modes and the waterway, including system delay functions with and without the project over time. Use this information to determine waterway use over time with and without the project based upon:

a. A comparison of costs for movements by the waterway and by the alternative mode, as modified by paragraph 6-69b.

b. Any changes in the cost functions and demand schedules comparing (1) the current and future without project conditions and (2) the current and future with project condition. Conceptually, this step should include all factors that might influence a demand schedule; e.g., impact of uncertainty in the use of the waterway; ownership of barges and special equipment; level of service; inventory and production processes; and the like. As a practical matter, the actual use of a waterway without a cost savings or nonuse of a waterway with a cost savings depends on the knowledgeable judgment of navigation economists and industry experts.

c. Account for the "phasing in" or "phasing out" of shifts from one mode to another in the analysis. Base diversion of traffic from other modes to the waterway, and from the waterway to other modes as the waterway becomes congested, on expected rate savings as adjusted by any other factors affecting the willingness of users to pay or the speed of the response mechanism to changes in the relative attractiveness of alternative modes. Specifically, determine diversions from congested waterways in the order of the willingness of users to pay for waterway transportation. Divert users with the lowest willingness to pay first.

6-7**2**. Evaluation Procedure: Step 10--Compute NED Benefits. Once the tonnage moving with and without a plan is know and the alternative costs and waterway costs are known, total NED navigation benefits can be computed at the applicable discount rate:

a. For cost reduction benefits, the benefit is the reduction in cost of using or operating the waterway; the cost of the alternative mode is a factor in determining whether the tonnage would move both with and without the project but is not a factor in computing benefits. Cost reduction benefits are generally limited to evaluation of existing waterways. The benefits for current and future cost reductions are reflected by the difference in waterway costs (steps 4 and 8) with and without the project. Compare waterway cost data (steps 4 and 8) with the alternative mode costs (steps 5 and 7) in order to determine the traffic flow by mode over time (steps 3 and 6).

b. For shift of mode benefits, the benefit is the reduction in costs when the alternative movement is compared with the waterway. These benefits apply to new or existing waterways. Cost differences between the alternative mode and the waterway mode (step 5 - step 4 x step 3 and step 7 - step 8 x step 6) will identify the shift of mode benefits over time.

c. For shift or origin-destination benefits and new movement benefits, the benefit is the value of the delivered product less the transportation and production costs with the project. The transportation cost without the project (assuming the with project movement would have occurred) is a factor in categorizing these benefits but is not a factor in computing them. The upper limit of these benefits can normally be determined by computing reduction in transportation charges achieved by the project. These can be a reduction in waterway costs (steps 4 and 8) with and without the project or changes in mode (step 5 - step 4 and step 7 - step 8).

6-7**3**. Evaluation Procedure: Problems in Application.

a. Changes in System Delays. Differences in system delays resulting from project alternatives are difficult to compute. An assessment of system delays within the state of the analytic art is necessary for a comprehensive benefit analysis. Delays at all points in the system should be analyzed only to the extent that project formulation and evaluation are sensitive to such refinements, and to the extent that the state of the art permits accurate refinement of the estimate. Appropriate proxy measures may be used in lieu of individual assessments at each element in the system when evaluating system delays.

b. Interaction of Supply and Demand Schedules. The entire evaluation procedure (paragraphs 6-61 through 6-72) is based on an assumption that the supply and demand schedules are independent; but in fact, they are not. This problem is most acute when considering the variance in delays at high levels of lock utilization. Essentially, shippers will face not an expected delay value but rather a highly uncertain delay value. Shippers' response to uncertainty (as reflected in the demand schedule) may be quite different from their response to an expected shipping cost (as reflected by the intersect of the supply and demand schedules).

c. User Fee Collection. The incremental collection of user charges, fees, or taxes is not a NED benefit. It is a transfer or resources between the private and public sectors of the economy, manifesting itself as resources committed to the proposed navigation system. The increased collection of these charges, fees, or taxes is therefore considered a decrease in the public sector's contribution to the proposed system.

d. Sensitivity Analysis. Project benefits are calculated on the basis of "the most probable" with project and without project conditions. However, risk and uncertainty should be addressed in the

analysis of NED benefits and costs. In particular, major uncertainty exists in the proper measure of savings to shippers, namely the difference in long-run marginal costs. To the extent that rates or other prices vary from long-run marginal costs, savings to shippers will contain a component of transfers varying from real resource savings. This element of uncertainty should always be identified or acknowledged in estimates of benefits. In dealing with uncertainty, three techniques may be used: establishing consistent sources of data, expanding the data-gathering, and estimating the range of benefits. Use the following two specific approaches to implement the third technique, and display the results in terms of their effects on project benefits in tabular form in the project report.

(1) Prespecified sensitivity analysis. Compute the following and include it in the report:

(a) Current tonnage, new waterway. For new waterways, compute benefits for the recommended alternative on the basis of current phased-in tonnage (steps 3 and 9c), current rates, and current fleet characteristics.

(b) Current rates, fleet. For both new and existing waterways, compute benefits for the recommended alternative on the basis of tonnage over time, current rates (step 3), and current fleet characteristics.

(c) Growth beyond 20-year period. Compute the benefits for alternatives carried forward for final display assuming no growth in tonnage or changes in fleet characteristics beyond 20 years in the future.

(d) Interest rate. For projects whose authorized discount rate is different from the current discount rate, compute annualized benefits using the current rate.

(e) User charges. Estimate the effect on benefits of full recovery through user charges.

(2) Other. In addition, the report should contain such other sensitivity analyses as are necessary to meet the objective of a clear, concise report presenting a range of benefit levels that represent data and assumptions about which reasonable persons might differ.

e. Data Sources. The following discussion summarizes key sources, including problems in their use.

(1) Interviews. Interview data may be used in steps 1 through 8. (Use only forms approved by the Office of Management and Budget.) Collect data not available from secondary sources by personal interviews. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in such a way as to prevent the disclosure of individual sources. Describe the errors and uncertainty inherent in the sampling methods and responses.

(2) Other. The basic organizational source for systematically collected waterway data is the Office of the Chief of Engineers.

6-7**4**. Report and Display Procedures. Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Tables 6-14 through 6-17 are suggested presentations for all reports that include navigational objectives. In addition

to detailed data on the NED benefits of a project, summary tables may present useful information on other aspects of the project such as its impact on commodity flows, on other modes of transportation, and on the location of economic activity. See the following sample tables.

Table 6-14
Summary of Annualized NED Benefits For Alternative Projects
(Applicable discount rate: ____)

	Alternatives			
	1	2	3	X
Navigation benefits:				
Cost reduction benefits	.....	.....	.....	.....
Shift of mode benefits	.....	.....	.....	.....
Shift in origin-destination benefits	.....	.....	.....	.....
New movement benefits	.....	.....	.....	.....
Total navigation benefits	.....	.....	.....	.....
Other purpose benefits	.....	.....	.....	.....
Total project benefits	.....	.....	.....	.....
Project costs	.....	.....	.....	.....
Net benefits	.....	.....	.....	.....

Table 6-15
Time Phasing of NED Benefits For Recommended Project[1]
(Applicable discount rate: ____)

	Time Period[1]						
	Base Years Specify	Decade[2]					
		1	2	3	4	5	AAE[3]
Navigation benefits:							
Cost reduction benefits:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....	.....	.....	.....
Benefits	.....	.....	.....	.....	.....	.....	.....
Shift mode benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....	.....	.....	.....
Benefits	.....	.....	.....	.....	.....	.....	.....
Shift in origin-destination benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....		.....	.....
Benefits					.....		
New movement benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....		.....	.....
(10^3 tons/year)					.....		
Benefits	.....	.....	.....	.....		.....	.....
Total navigation benefits							
Other purpose benefits							
Total project benefits							

[1]Comparable tables may be made for all detailed alternatives.
[2]Value for last year of decade. [3]Average annual equivalent.

Table 6-16
Waterway Traffic and Delays, Without Project Condition

	Current Year	Base Year	Time Period[1]					
			Decade					
			1	2	3	4	5	AAE[2]
Waterway traffic (10^3 tons/year).....	.....	.....	.....	.....	.....	.....	.....	.....
(By major commodity group)								
Delays (minutes/tow):								
Study site	.....	.....	.....	.....	.....	.....	.....	.....
Critical constraints	.....	.....	.....	.....	.....	.....	.....	.....
Total system	.....	.....	.....	.....	.....	.....	.....	.....
Delays (dollars/ton):								
Study site	.....	.....	.....	.....	.....	.....	.....	.....
Critical constraints	.....	.....	.....	.....	.....	.....	.....	.....
Total system	.....	.....	.....	.....	.....	.....	.....	.....

[1]Value for last year of decade.
[2]Average annual equivalent.

Table 6-17
Waterway Traffic and Delays, With Recommended Project[1]
(Applicable discount rate: ____)

	Time Period[1]						
	Base Year	Decade[2]					
		1	2	3	4	5	AAE[3]
Waterway traffic (10^3	.....	.....	.....	.....	.....	.....	.....
tons/year).....	.....	.....	.....	.....	.....	.....	.....
(By major commodity group)							
	.....	.....	.....	.....	.....	.....	.....
Delays (minutes/tow):							
Study site.....							
Critical constraints	.....	.....	.....	.....	.....	.....	.....
Total system..							
	.....	.....	.....	.....	.....	.....	.....
Delays (dollars/ton):	.....	.....	.....	.....	.....	.....	.....
Study site.....							
Critical constraints	.....	.....	.....	.....	.....	.....	.....
Total system..							

[1]Comparable tables may be made for all detailed alternatives.
[2]Value for last year of decade.
[3]Average annual equivalent.

SECTION VII - NED BENEFIT EVALUATION PROCEDURES: TRANSPORTATION DEEP-DRAFT NAVIGATION

6-7**5**. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the deep-draft navigation features of water resources plans and projects. Deep-draft navigation features include construction of new harbors and channels and improvements to existing or natural harbors on the sea coasts to meet the requirements of ocean-going and Great Lakes shipping. Harbor improvements include such structural projects as the construction of breakwaters and jetties to protect exposed harbors and the provision of entrance channels, interior channels, turning basins, and anchorage areas. Nonstructural deep-draft measures include improved traffic management and pilotage regulations. **[Risk-based analysis procedures for deep-draft navigation studies are currently being developed by the Institute of Water Resources. Unlike the current risk-based flood damage model, the navigation model will integrate both benefit uncertainty, related to fleet and commodity forecasts and vessel operating costs, with cost uncertainty related to dredging and disposal costs. Districts are expected to continue to use risk and uncertainty techniques in all navigation studies, at least in the form of sensitivity analyses, prior to field release of the risk-based navigation models.]**

6-7**6**. Conceptual Basis. The basic economic benefits from navigation management and development plans are the reduction in the value of resources required to transport commodities and the increase in the value of output for goods and services. Specific transportation savings may result from the use of larger vessels, more efficient use of large vessels, more efficient use of existing vessels, reductions in transit time, lower cargo handling and tug assistance costs, reduced interest and storage costs such as from an extended navigation season, and the use of water transportation rather than an alternative land mode. Principal direct benefits are categorized as follows:

a. Cost Reduction Benefits. If there is no change in either the origin or destination of a commodity, the benefit is the reduction in transportation costs of quantities of the commodity that would move with and without the plan resulting from the proposed improvement. Cost reduction benefits apply in the following situations:

(1) Same commodity, origin-destination, and harbor. This situation occurs where commodities now move or are expected to move via a given harbor or without the proposed improvement.

(2) Same commodity, and origin-destination, different harbor. This situation occurs where commodities that are now moving or are expected to move via alternative harbors without the proposed improvement would, with the proposed plan, be diverted through the subject harbor. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels.

(3) Same commodity and origin-destination, different mode. This situation occurs where commodities that are now moving or are expected to move via alternative land modes without the proposed improvement would, with the proposed plan, be diverted through the subject harbor or channel. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels. Compute cost reduction benefits for alternate modes in accordance with Section VI (See paragraph 6-**60**e).

b. Shift of Origin Benefits. If there is a change in the origin of a commodity as a result of a proposed plan but no change in destination, the benefit is the reduction in the total cost of producing and transporting quantities of the commodity that would move with and without the plan.

c. Shift of Destination Benefits. If there is a change in destination of a commodity as a result of a proposed plan but no change in origin, the benefit is the change in net revenue to the producer for quantities that would move with and without the plan.

d. Induced Movement Benefits. If a commodity or additional quantities of a commodity are produced and consumed as the result of lowered transportation costs, the benefit is the value of the delivered commodity less production and transportation costs. More precisely, the benefit of each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. Where data are available, estimate benefits for various increments of induced movement. In the absence of such data, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

6-7**7**. Planning Setting. The planning setting consists of the physical, economic, and policy conditions that influence and are influenced by a proposed plan or project over the planning period. The planning setting is defined in terms of a without project condition and with project condition.

a. Without Project Condition. The without project condition is the most likely condition expected to exist over the planning period in the absence of a plan, including any known change in law or public policy. It provides the basis for estimating benefits for alternative with project conditions. Assumptions specific to the study should be stated and supported. The basic assumptions for all studies are:

(1) Nonstructural measures within the authority and ability of port agencies, other public agencies, and the transportation industry determine changes that are likely to occur. These measures consist of reasonably expected changes in management and use of existing vessels and facilities on land and water. Examples are lightering, tug assistance, use of favorable tides, split deliveries, topping-off, alternative modes and ports, and transshipment facilities.

(2) Alternative harbor and channel improvements available to the transportation industry over the planning period include those in place and under construction at the time of the study and those authorized projects that can reasonably be expected to be in place over the planning period.

(3) Authorized operation and maintenance is assumed to be performed in the harbors and channels over the period of analysis unless clear evidence is available that maintenance of the project is unjustified.

(4) In projecting commodity movements involving intermodal movements, sufficient capacity of the hinterland transportation and related facilities, including port facilities, is assumed unless there are substantive data to the contrary.

(5) A reasonable attempt should be made to reflect advancing technology affecting the transportation industry over the period of analysis. However, the benefits from improved technology

should not be credited to the navigation improvement if the technological change would occur both with and without the plan.

b. With Project Condition.

(1) The with project condition is the one expected to exist over the period of analysis if a project is undertaken. Describe the with project condition for each alternative plan. Since benefits attributable to each alternative will generally be equal to the difference in the total transportation costs with and without the project, the assumptions stated for he without project condition are used to establish the with project condition for each alternative.

(2) Management practices that are sometimes within the discretion of a public entity and are therefore subject to change in the with condition include traffic management, pilotage regulations, addition of berths, and additions or modifications to terminal facilities.

c. Display. In the planning report, present the derivation and selection of with and without project conditions in accordance with the following guidelines:

(1) State the assumptions specific to the study.

(2) Specify the significant technical, economic, environmental, social, and other elements of the planning setting to be projected over the period of analysis. Discuss the rationale for selecting these elements.

(3) Present the with and without project conditions in appropriate tabular and graphic displays with respect to the elements selected as in paragraph 6-7**7**c(2) and as exemplified by Tables 6-18, 6-20, and 6-21.

6-7**8**. Evaluation Procedures: General. Use the following steps to estimate navigation benefits. The level of effort expended on each step depends upon the nature of the proposed improvement, the state-of-the-art for accurately refining the estimate, and the sensitivity of project formulation and evaluation to further refinement. A flow chart of navigation evaluation procedures is shown in Figure 6-6. **[Additional detailed support material for conducting NED evaluation may be found in Deep Draft Navigation (IWR Report 91-R-13, October 1987). This manual provides an expanded description of benefit evaluation procedures for all commercial navigation projects not a part of the inland waterways system. It also provides sources of information to identify and estimate future project use. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within this IWR report.]**

6-7**9**. Evaluation Procedure: Step 1--Determine the Economic Study Area. Delineate the economic study area that is tributary to the proposed harbor and channel improvement. Assess the transportation network functionally related to the studied improvement, including the types and volumes of commodities being shipped, in order to determine the area that can be served more economically by the improvement. Include foreign origins and destinations in this assessment. Consider diversion from or to adjacent competitive harbors as well as distribution via competing modes of transport. It should be recognized that the lines of demarcation for the economic study area are not fixed and that the area may expand or contract as a result of innovations or technological advances

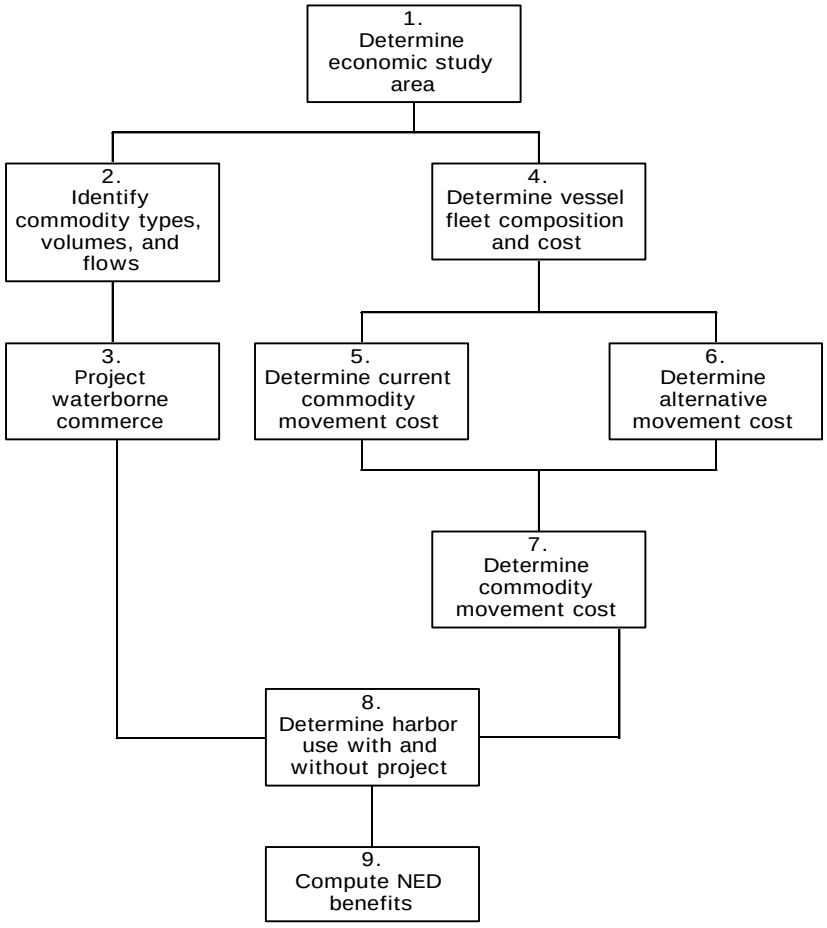


Figure 6-6. Flowchart of Deep-Draft Navigation Benefit Evaluation Procedures

in transportation and/or production or utilization of a particular commodity. The economic study area is likely to vary for different commodities. Combinations of economic areas will result in a trade area delineated specifically for the improvement under study. However, in many cases, due to the close proximity of adjacent harbors to the proposed improvement, the economic study area may be the same as, or overlap with, such adjacent harbors. Therefore, in the final delineation of the economic study area for a given improvement, there should be adequate discussion of the trade area relative to adjacent ports and any commonality that might exist.

6-**80**. Evaluation Procedure: Step 2--Identify Types and Volumes of Commodity Flow. To estimate the types and volumes of commodities that now move on the existing project or that may be attracted to the proposed improvement, analyze commerce that flows into and out of the economic study area. This analysis provides an estimate of gross potential cargo tonnage; the estimate is refined to give an estimate of prospective commerce that may reasonably be expected to use the harbor during the period of analysis in light of existing and prospective conditions. If benefits from economics of ship size are related to proposed deepening of the harbor, the analysis should concentrate on the specific commodities or types of shipments that will be affected. Thus, an historical summary of types and trends of commodity tonnage should be displayed. The considerations generally involved in estimating current volumes of prospective commerce are:

a. If the plan consists of further improvements to an existing project, statistics on current waterborne commerce will provide the basis for evaluation. For new harbors with no existing traffic, or for existing commodity movements that may be susceptible to diversion from adjacent harbors, basic information is collected by means of personal interviews or questionnaires sent to shippers and receivers throughout the economic study area. Secondary commercial data are usually available through State and local public agencies, port records, and transportation carriers. In the case of new movements, give attention of resource and market analyses.

b. After determining the types and volumes of commodities currently moving or expected to move in the economic study area, it is necessary to obtain origins, destinations, and vessel itineraries in order to analyze the commodity types and volumes that are expected to benefit from the proposed improvement. Commodities that are now moving without the project but would shift origins or destinations with the project, as well as induced movements, should be segregated for additional analysis (see steps 5 and 6). A study should be made of various alternatives for the existing traffic and of new traffic susceptible to diversion from alternative harbors or other modes of transportation. The objective of such a study is to determine the type and volume of those commodities for which savings could be affected by movement via a proposed navigation improvement and the likelihood that such movements would occur. Cost reduction benefits sufficient to divert traffic from established distribution patterns and trade routes are navigation project benefits. In determining the likelihood of prospective commerce, particular attention should be given to alternative competitive harbors in the case of new movements and to hinterland traffic. Elements of analysis of current tonnage include: size and type of vessel, annual volume of movements, frequency of movements, volume of individual shipments, adequacy of existing harbor and transportation facilities, rail and truck connections, and service considerations. Generally this prospective traffic is the aggregate of a large number of movements (origin-destination pairs) of may commodities; the benefit from the navigation project is the savings on the aggregate of these prospective movements.

6-8**1**. Evaluation Procedure: Step 3--Project Waterborne Commerce. Develop projections of the potential use of the waterway under study for selected years from the time of the study until the end

of the project life, over time intervals not to exceed 10 years. Document commodity projections for the commodity groups identified in step 2.

a. The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and availability of data and previous studies.

b. Generally, OBERS projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of OBERS-derived indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by OBERS. Even when total commodity flows can be adequately described through the use of indices derived from OBERS projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by OBERS.

c. If problems of the type described in paragraph 6-**81**b are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data with (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts; and (3) historical flow patterns. Commodity projects can then be constructed on he basis of the results of the independent studies.

d. Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life through the use of general indices on a regional and industry basis. Such indices can be constructed from the OBERS projections or other generally accepted multi-industry and regional models. Describe projection methods selected in sufficient detail to permit a review of their technical adequacy.

(1) Sensitivity analysis of several levels of projections is used for the economic analysis. There may be a high level projection embodying optimistic assumptions and a low level projection based on assumptions of reduced expectations. The high and low projections should bracket the most foreseeable conditions. The third and fourth levels of projections can reflect the with- and without project conditions based on the most likely estimates of the future. If a proposed plan would not induce commodity growth, one level of projection may be shown for both the with and without project conditions. (See Chapter 5, Section I)

(2) The commodities included in the projections should be identified, if possible, according to the following waterborne modes: containerized, liquid bulk, dry bulk, break-bulk, etc. Projection-related variables include estimated value, density, and perishability. The commodities should also be categorized by imports, exports, domestic shipments, domestic receipts, and internal trade. Projected tonnages by trade areas both with and without the project should be displayed at least for the study year, the base year, fifth year, tenth year, and then by decades over the period of the analysis.

(3) Most projections of waterborne commerce are static estimates of dynamic events; therefore, the projections should be sufficiently current to support the report conclusions.

6-8**2**. Evaluation Procedure: Step 4--Determine Vessel Fleet Composition and Cost.

a. Vessel Fleet Composition. Key components in the study of deep-draft harbor improvements are the size and characteristics of the vessels expected to use the project. Present data on past trends in vessel size and fleet composition, and on anticipated changes in fleet composition over the project life. Use estimates of future fleet consistent with domestic and world fleet trends. Undertake studies to the extent necessary to determine the appropriate vessel fleet. The assessment of available secondary data forms the basis of the independent studies. Data may be obtained from various sources including the U.S. Department of Transportation (Maritime Administration), trade journals, trade associations, shipbuilding companies, and vessel operating companies. Determine the composition of the current and future fleet that would utilize the subject harbor with and without the proposed improvement. Provide adequate lead time for anticipated changes in fleet composition for vessels that are currently a small part of the world fleet. Size selection may vary according to trade route, type of commodity, volume of traffic, canal restrictions, foreign port depths, and lengths of haul. It may not be realistic to assume that the optimum size vessel is always available for charter; the preferred approach is a fleet concept that includes a range of vessels expected to call with and without the project. It is suggested that tabulations in the reports show composition of vessel fleets by deadweight tonnage for each type of vessel beginning with the current fleet and by decades through the period of analysis. Historical records of trips and drafts of vessels calling at the existing project should also be displayed.

b. Vessel Operating Costs. To estimate transportation costs, obtain deep-draft vessel operating costs for various types and classes of foreign and United States flag vessels expected to benefit from using the proposed improvement. Since vessel operating costs are not readily available from ocean carriers or from any central source, the Corps of Engineers, Water Resources Support Center, will develop and provide such costs on an annual basis for use in plan evaluation. Planners should determine to what extent these estimates of vessel costs must be modified to meet the needs of local conditions. Document and display selected vessel operating costs in the report.

6-8**3**. Evaluation Procedure: Step 5--Determine Current Cost of Commodity Movements. Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2. Transportation costs include the full origin-to-destination cost, including necessary handling, transfer, storage, and other accessory charges. Construct costs for the with and without project condition. The without project condition is based on costs and conditions prevailing at the time of the study. Transportation costs with a plan reflect any efficiencies that can be reasonably expected, such as larger vessels, increased loads, reduction in transit time and delays (tides), etc. Use competitive rates, rather than costs, for competitive movements by land (See paragraphs 6-7**6**a(3), 6-**60**e, and 6-6**7**b). This concept also applies to Steps 6, 7, and 9 and elsewhere where a competitive movement by land is an alternative.

6-8**4**. Evaluation Procedure: Step 6--Determine Current Cost of Alternative Movement. Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2 for alternative movements. The cost includes the full origin-to-destination cost. Such alternatives include competitive harbors, lightering, lightening and topping-off operations, off-shore port facilities, transshipment terminals, pipelines, traffic management, pilotage regulations, and other modes of transportation. Consider competitive harbors with existing terminal facilities and sufficient capacities as possible alternatives for traffic originating in or destined to the hinterland beyond the confines of the harbor and for all other new commerce as well as all diverted traffic. Commerce with final origins and destinations within the confines of the study harbor is normally noncompetitive with other harbors and need not be

considered for diversion unless unusual circumstances exist. Diversion of established commerce now moving through the existing harbor to or from the hinterland is dependent on many different cost and service factors; therefore, to ensure that all of these factors are included in the analysis, interviews, and consultations with shippers and receivers should be conducted prior to any determination concerning diversion of traffic. Factors to be considered in the analysis include transportation costs for both inland and ocean movement, handling and transfer charges, available service and schedules, carrier connections, institutional arrangements, and other related factors. In addition, for commodities with shifts in origins and destinations, as well as for new movements, collect data on the value of the delivered product as well as production and transportation costs for shipments with the project. The specific data and method of collection will vary with the specific situation and the nature of the benefit.

6-8**5.** Evaluation Procedure: Step 7--Determine Future Cost of Commodity Movements. Estimate relevant shipping costs during the period of analysis and future changes in the fleet composition, port delays, and port capacity under the with and without project conditions for each alternative improvement under study. Base future transportation costs on the vessel operating cost prevailing at the time of the study. Additional data may be needed to analyze the relationship between total volume and delay patterns and the port capacity for the with and without project conditions for each alternative. Changes in costs due to the project should be identified and separated from changes due to other factors.

6-8**6**. Evaluation Procedure: Step 8--Determine Use of Harbor and Channel With and Without Project. At this point, the analyst will have a list of commodities that potentially might use the proposed improvement; potential tonnages of each commodity or commodity group; transportation costs for alternatives and for the proposed improvement; and present and future fleet composition with and without the proposed plan. To estimate the proposed harbor use over time, both with and without the project, compare costs, other than projects costs, for movements via the proposed plan and via each alternative. Analyze any changes in the cost functions and demand schedules in the current and future without condition and the current and future with condition. Conceptually, this step includes all factors that might influence a demand schedule. Determine the impact of uncertainty in the use of the harbor, the level of service provided, and existing and future inventories of vessels. Provide adequate lead time for adoption for vessels that are currently a small percentage of the world fleet.

6-8**7.** Evaluation Procedure: Step 9--Compute NED Benefits. Once the tonnage moving with and without a plan is known and the cost via the proposed harbor and via each alternative are known, compute total NED navigation benefits will be computed using the applicable discount rate.

a. Cost Reduction Benefits.

(1) Traffic with same commodity, origin-destination, and harbor. For traffic now using the harbor or expected to use it, both with and without the proposed project, the transportation benefit is the difference between current and future transportation cost for the movement by the existing project (without project condition) and the cost with the proposed improvement (with project condition).

(2) Traffic with same origin-destination; different harbor. For commerce shifted to the proposed improvement from other harbors or alternatives, including future growth, the benefit is any reduction in current and future costs when movement via the proposed improvement is compared with each alternative.

(3) Traffic with same commodity and origin-destination, different mode. For commerce shifted to the proposed improvement from other modes, the benefit is any reduction in current and future costs to the producer or shipper. (See paragraph 6-7**6**a(3) when movement via the proposed improvement is compared with each alternative.)

b. Shift of Origin Benefits. For commerce that originates at a new point because of the proposed improvement, the benefit is the difference between the total cost of producing and transporting the commodity to its destination with and without the plan.

c. Shift of Destination Benefits. For commerce that is destined to a new point because of the proposed improvement, the benefit is the difference in net revenues to producers with and without the plan.

d. Induced Movement Benefits. If a commodity or additional quantities of commodity are produced and consumed as a result of a plan, the benefit for each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. To determine the maximum cost other shipper would be willing to pay, estimate how much of a price increase it would take to induce the producer to increase its output by each increment or how much of price decrease it would take to induce consumers to increase their consumption by each increment. In the absence of data suitable for incremental analysis, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

6-8**8**. Evaluation Procedure: Problems in Application.

a. Multiport Analysis. This procedure calls for a systematic determination of alternative routing possibilities, regional port analyses, and intermodal networks that may require the use of computer modeling techniques. The data needed for such a determination are often difficult to obtain; therefore, interviews with knowledgeable experts will often have to be relied upon.

(1) The economic study area tributary to the proposed harbor project is likely to vary for different commodities because of differences in hinterland transportation costs and facilities, and presence of competing ports. The trade area for any given port must be defined in cognizance of trade areas for adjacent or competing ports.

(2) Potential reductions in transportation costs due to a proposed project result in transportation benefits with varying degrees of certainty. The certainty of the benefit is related to the certainty that the commodity movements will take place, with benefits for existing movements most certain. Analysis of potential or prospective movements must consider competing ports, hinterland transportation, vessel itineraries, ultimate origins or destinations of commodities, and assess the certainty with which benefits will accrue.

(3) A port study must recognize the degrees to which the ships that call or might call at that port are part of a larger waterborne transportation system. Specifically, the characteristics of vessels and the composition of the vessel fleet are affected in varying degrees by changes in costs or conditions at one port. A proposed deepening at a particular port, for example, may have more effect on some ships calling there than others if the ships have different modes of operation. Some bulk carriers may

be affected because only one other port is served, while container operations may not be much affected because several additional ports are served. The size and characteristics of ships expected to use a project shall be determined in light of the transportation systems in which they operate, as well as world and domestic trends in fleet composition.

(4) US ports operate in a system(s). A study that appropriately considers a port in isolation will be rare. In such a case the report shall document why systems considerations are not relevant.

b. Ultimate Origins and Destinations. The procedure calls for an analysis of full origin-destination costs to determine routings as well as to measure benefits in some instances. Problems will arise in determining the ultimate origins and destinations of commodities and in determining costs. Therefore, the analyst should attempt to shorten the analysis to the most relevant cost items.

c. Underkeel Clearance and Risk Analysis. The purpose of Corps of Engineers' underkeel design standards is to provide clearance between a ship's bottom and a channel's bottom, which minimizes the risk of grounding by a design vessel under design conditions in the design channel. That is, underkeel clearances are engineering judgment on the minimum amount of clearance to assure safety and do not necessarily reflect actual behavior. When ships appear to operate with substandard underkeel clearances, procedures for correct delineation of transportation costs and project benefits may seem ambiguous.

(1) The starting point in analysis is to develop an accurate picture of the existing conditions. Accurate information on operating practices is particularly important; without this, reasonable without project and with project conditions, and hence economic analysis, is not possible. Entering and departing vessel drafts in economic analysis shall reflect actual practices. Adherence to Corps clearance standards shall not be assumed.

(2) Determine whether observed apparent deviations from underkeel clearance standards represent actual encroachments in the safety zone. Apparent encroachments may be due to ships' physical characteristics (e.g. size) and operating characteristics (e.g. speed, trim) which differ from the design ship's characteristics, or from navigation conditions (e.g., wave climate) less severe than the design conditions. Alternatively the apparent deviations may be due to use of favorable tides or lake levels, or to exploitation of actual channel depths which differ from authorized depths. Benefits shall be based on differences in transportation cost, taking into account without project actual operating practices and with project actual operating practices. Adjustments may be taken, as appropriate, to the extent that these practices themselves affect transportation costs (e.g., tidal delays, costs of reduced speed or changing trim).

(3) For cases where it is determined that encroachment in the safety zone is taking place, risk accepting behavior may be assumed. The following benefit evaluation logic shall be used: Transportation firms will accept risk up until the point where the incremental revenue from accepting risk equals the incremental risk cost of doing so. Estimate the incremental revenue associated with navigation at successively deeper drafts (I. e. smaller clearances) for those ships which use the safety zone. Estimate the risk costs (e.g., probability weighted cost of grounding) for those ships. Equilibrium between incremental revenue and incremental risk cost may be assumed to occur at the actual operating drafts (clearances) of those ships. Benefits are the area under the incremental revenue curve and costs are the area under the incremental risk cost curve, between the without and with operating depths.

d. User Fees. The Water Resources Development Act of 1986 enabled non-Federal interests, as a means of financing a harbor project's local cost share, to collect user fees from vessels. Non-Federal interests are not directed to use fees to finance the local cost share, but if a fee is used only the benefiting vessels may be assessed charges.

(1) At the time of feasibility studies it may not be known with certainty whether user fees will be charged. The with project condition for economic analysis shall use planners' best appraisal regarding the likelihood of fees being assessed, taking into account the intentions of the non-Federal interest, practices at other ports, the willingness of vessels to pay user fees, and the competitiveness of alternative ports in light of fees at the project port.

(2) As a sensitivity, conduct an analysis using the alternative assumption.

(3) For cases with user fees, assess the effect of the fees on transportation rates and the levels of traffic at the project port, taking into account the type of use fee (e.g., ad valorem, lump sum, etc.). That portion of transportation charges to shippers that reflects user fees is credited as a benefit of the project. The fees are in effect a reimbursement of project costs which are otherwise accounted for in the benefit-cost analysis.

e. Sensitivity Analysis. Guidance for addressing risk and uncertainty in the analysis is found in Supplement I to Chapter I. The uncertainty in the estimates of critical variables should be dealt with. These variables specifically related to deep-draft navigation may be traffic projections, especially foreign shipments, fleet composition, and cost of commodity movements. **[Refer to paragraph 6-75 for current status of implementation of risk-based analysis in deep-draft studies.]**

f. Data Sources. The following discussion summarizes key data sources including problems in their use:

(1) Interviews. Collect data not available from secondary sources by personal interviews. (Use only interview forms approved by the Office of Management and Budget.) Display the questionnaire used and summary of responses in the project report in such a way that individual sources are not disclosed.

(2) Publications. Data concerning commerce in foreign trade, United States coastal shipping, and activities of U.S. flag vessels in foreign trade, together with limited data concerning the world fleet, are readily available from a number of Federal agencies, trade journals, and port publications. However, data concerning the foreign-flag fleet are often not regularly available in up-to-date form from sources in the United States. Principal governmental sources are the U.S. Army Corp of Engineers, the Maritime Administration and the Bureau of the Census. For more detailed background on world fleet trends, shipping outlooks, and vessel characteristics, available foreign literature must be carefully analyzed. A few of the available foreign ship registers and literature are listed below to illustrate the type of data available from foreign sources.

Lloyd's Register of Shipping, London (Annual).
The Tanker Register, H. B. Clarkson (Annual).
The Bulk Carrier Register, H. B. Clarkson (Annual).
Shipping Statistics and Economics (and special reports), H. P. Drewry, London (Weekly).
Fairplay International Shipping Journal (and special reports), London (Weekly).

6-8**9**. Report and Display Procedures. Clear presentation of study results, as well as documentation of assumptions and steps in the analysis, will facilitate review of the report. The accompanying tables are suggested. The number of displays will depend on the complexity of the study.

Table 6-18
Projected Vessel Fleet Size Distribution,[a]
Ft. Channel Plan
(by Percentage)

Vessel size (D.W.T.)	Current[b]	Percentage of tonnage					
		Base Year c	Year 5	Year 10	Year 20	Year --	Year end
Total	With Project						
Total	Without Project						

Table 6-19
Typical Vessel Dimensions of Vessel Fleet
by Type and Deadweight Tonnage

Type	Vessel characteristics			
	DWT	Length	Beam	Draft, loaded

Table 6-20
Projected Commerce for Deep-Draft Traffic

Commodity[1]	Current year[2]	Base Year[3]	Year 5	Year 10	Year 20	Year --	Year --	Year end	Average Annual
With project									
Without Project									

[1]Commodities should be categorized by trade area.
[2]Study year.
[3]First year of project benefits.

Table 6-21
Projected Vessel Trips for Deep-Draft Traffic

Commodity[1]	Current year[2]	Base Year[3]	Year 5	Year 10	Year 20	Year --	Year --	Year end	Average Annual
With project									
Without Project									

[1]Commodities should be categorized by trade area.

[2]Study year. [3]First year of project benefits.

SECTION VIII - NED BENEFIT EVALUATION PROCEDURE: RECREATION

6-**90**. Purpose. This section provides the procedures for evaluating the beneficial and adverse effects of water project recreation on national economic development (NED). The Federal Water Project Recreation Act of 1965 (Public Law 89-72) requires that full consideration be given to the opportunities that Federal multipurpose and other water projects afford for outdoor recreation and associated fish and wildlife enhancement.

6-9**1**. Conceptual Basis.

a. General.

(1) Benefits from recreation opportunities created by a project are measured in terms of willingness to pay. Benefits for projects (or project features) that increase supply are measured as the willingness to pay for each increment of supply. Benefits for projects (or project features) that alter willingness to pay (e.g., through quality changes) are measured as the difference between the without and with project willingness to pay. Willingness to pay includes entry and use fees actually paid for site use plus any unpaid value (surplus) enjoyed by consumers. (Payment for equipment, food, transportation costs, or lodging associated with recreation activity cannot be used as direct estimates of willingness to pay, because these payments are not specifically for site use.) The total willingness to pay is represented as the area under the demand curve between the old and new supply. Because most recreation is publicly provided, it is usually not possible to estimate demand directly from observed price-consumption data. This section describes procedures for estimating use and willingness to pay by means of travel behavior, user surveys, and other quantifiable measures.

(2) Many proposed projects subject to NED benefit-cost analysis involve both recreation gains and recreation losses. **Section 928 of the Water Resources Development Act of 1986 require, for projects having recreation benefits, analysis of the effects of the proposed project on existing recreation resources.** For example, stream and land-based recreation may be lost because of the project, or recreation may be transferred to the proposed site from a more distant site. Net recreation benefits are the value of the gains minus the value of the losses; benefits may be positive or negative. Since reliable empirical methods for estimating willingness to accept compensation for losses have not been developed, measures of willingness to pay are used to value both gains and losses. Evaluation procedures should be based on sound economic rationale and have an empirical basis that permits an objective and reproducible analysis of benefits and costs. **Reports shall include:**

(a) A description of the alternative or competing facilities and their existing and future use, with and without the proposed project. Describe alternative resource use at a level of detail roughly similar to that used to describe use of the proposed project. For example, if peak and non-peak attendance, types of facilities and categories of use, etc., are used to characterize the proposed project, a similar level of detail shall also be used to describe the competing resources.

(b) Analysis of the proposed project which takes into account use of the alternative resources. Estimate benefits of the proposed project net of benefits of the alternative facilities. For example, beach recreation benefits for a proposed project are net of benefits from use of an alternative beach in the without project condition.

b. Criteria for an Acceptable Evaluation Procedure. An acceptable evaluation procedure has the following characteristics:

(1) Evaluation is based on an empirical estimate of demand applied to the particular project.

(2) Estimates of demand reflect the socioeconomic characteristics of market area populations, qualitative characteristics of the recreation resources under study, and characteristics of alternative existing recreation opportunities.

(3) Evaluation accounts for the value of losses or gains to existing sites int the study area affected by the project (without project condition).

(4) Willingness to pay projections over time are based on projected changes in underlying determinants of demand.

c. Description of Evaluation Methods. The procedures described in this section incorporate three evaluation methods. They are the travel cost method (TCM), contingent valuation method (CVM), and unit day value (UDV) method. The use of any other method should be justified as conforming to the characteristics listed in paragraph 6-9**1**b and the selection process described in paragraph 6-9**1**d.

(1) Travel cost method. The basic premise of the travel cost method is that per capita use of a recreation site will decrease as out-of-pocket and time costs of traveling to the site increase, other variables being constant. TCM consists of deriving a demand curve by using the variable costs of travel and the value of time as proxies for price. This method may be applied to a site-specific study or a regional model.

(2) Contingent valuation method. The contingent valuation method estimates NED benefits by directly asking individual households their willingness to pay for changes in recreation opportunities at a given site. Individual values may be aggregated by summing willingness to pay for all users in the study area. This method may be applied to a site-specific study or a regional model.

(3) Unit day value. The unit day value method relies on expert or informed opinion and judgment to estimate the average willingness to pay of recreational users. By applying a carefully thought-out and adjusted unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits.

d. Selection of Evaluation Procedure. Select a procedure for evaluating each of the following two categories of project-related use: (1) total or gross expected use of project facilities, including transfers of use from other sites; (2) and existing site use displaced or destroyed by project facilities. The criteria for selecting the appropriate procedure for each category are set out in Figure 6-7. Application of the criteria may result in selection of different procedures for the two categories. The criteria given in Figure 6-7 consider several dimensions of project evaluation situations: Three measures of the absolute and relative size of the recreation benefit created, displaced, or transferred by the proposed project, and the nature of the recreation activities affected. If either use category specified above involves more than 750,000 annual visits, use either a regional model or site-specific study to evaluate benefits or benefits foregone. If recreation in an important project component relative to other outputs and costs, or if specialized activities (those for which opportunities in general are limited,

intensity of use is low, and users' skill, knowledge, and appreciation is great) are affected, the criteria also require greater accuracy in benefit estimates. If both specialized activities and general recreation are affected by the project, the choice between a regional model and a more limited site-specific study is at the discretion of the agency, based on consideration of the relative importance of the specialized activity, the advantages of the respective methods, and cost considerations.

(1) Restrictions on UDV Use. The general principle for the recreational analysis is, the more important recreation benefits are in plan formulation and/or plan selection and the more costly recreation components are, the more important is economically sound and empirically defensible analysis. The arguments for employing the user day approach can be based on two foundations:

(a) Infeasibility for technical reasons or due to study cost considerations;

(b) Formulation or plan selection not materially affected by willingness to pay value or by expected visitation. Study cost considerations do not simply mean the least study cost method is chosen, quality of analysis and results must be considered. The reasons for choosing a particular benefit evaluation method must be documented in the planning reports.

(2). Required Visitation Documentation. The UDV approach in recreation benefit analysis consists of two parts: estimating visitation and determining value per visit. Both must be documented in planning reports. Of the two parts, the determination of UDV is subjective; the visitation is not. Projected visitation must be based on data, either at the existing project or by comparisons with other similar resources. Historic and existing visitation and the capacity of the proposed project and its substitutes should be displayed. Expected visitation at the proposed project, in the without project and with project conditions, should be analyzed taking into account transfers from substitute recreation resources. Reasonableness of visitation should be established. This can sometimes be done via comparisons to other verifiable data (e.g. visitation at other similar resources, comparison to statewide participation data, references to other credible modeling studies, smaller scale surveys than would be required in CVM, etc). The key ingredients are reasonableness and documentation.

(3). Required Procedure for Determining Willingness to Pay Surrogate. Unit day values are to be developed using a point rating scale. Use of a particular point rating scale is not limited to the one presented at the end of this section. Additional and/or substitute rating criteria are allowed and encouraged. Resource and socioeconomic characteristics similar to those which would form the independent variables in a willingness-to-pay model are candidates for additional/substitute rating criteria. Similar recreation resources in the region should be surveyed for comparison to the proposed project. The main constraint is the range of monetary values. Point ratings are developed in a systematic, consistent and documented process; public participation in assigning point values lends credibility to this essentially subjective process. Changes in the quantity and quality of a recreation experience must be directly related to the nature of the Federal project. For example changes in the ease of use or convenience of a small boat harbor have no effect on the environmental quality of the primary resource (ocean, bay, etc). Note, unit day value does include entry and use fees actually paid for the site. Therefore, entry and use fees should not be added to the unit day value to determine total willingness to pay.

[e. Additional Reference Material. Additional detailed support material for conducting NED evaluation may be found in the following reference documents. Policy statements in this regulation take

precedence in any apparent contradiction suggested by information contained within these IWR reports.

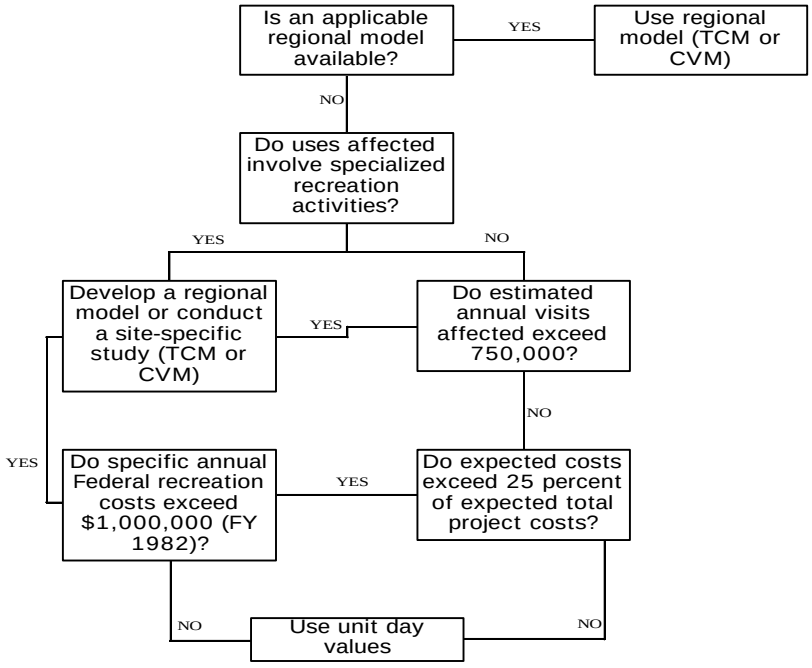


Figure 6-7. Criteria for Selecting Procedures for Evaluating Recreation Benefits

(1) Recreation, Volume I, Recreation Use and Benefit Estimation Techniques (IWR Report 86-R-4, March 1986)--This manual provides an expanded description of recreation evaluation procedures. It summarizes the conceptual basis for recreation valuation, describes the mechanics of valuation methods, and offers criteria for determining the applicability of various methods to particular planning situations.

(2) Recreation, Volume II, A Guide for Using the Contingent Value Methodology in Recreation Studies (IWR Report 86-R-5, March, 1986)--This manual presents the concepts and background required for using the CVM, and contains several examples to further describe the basic process required in its application.

(3) Recreation, Volume III, A Case Study Application of Contingent Value Method for Estimating Urban Recreation Use Benefits (IWR Report 90-R-11, November, 1990)--This manual documents, through a case study demonstration, the practical application of the CVM method in an actual recreation planning study. Objectives include illustration of the CVM in the estimation of recreation use and benefits in an urban valuation models, and discussion of the potential transferability of the process and findings to other planning applications.

(4) Recreation, Volume IV, Evaluation Changes in the Quality of the Recreation Experience (IWR Report 91-R-7, July, 1991)--This manual emphasizes the evaluation of changes resulting from a shift in the demand schedule (rather than the emphasis on increases in supply, in Volumes I-III), primarily brought about as a result of management decisions impacting on recreation facilities and services and on the related natural resource base.]

6-9**2**. Planning Setting.

a. General. Determine changes in recreation use and value resulting from alternative plans through analysis or without project and with project conditions in the study area over the prescribed period of analysis.

b. Without Project Condition. The without project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis in the absence of the recreation project or plan. The without project condition includes existing water and related land recreation resources, and projects and additional recreation resources currently being developed or both authorized and likely to be developed during this period.

c. With Project Condition. The with project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis with a recreation plan or project. Recreation resources included in the without project condition provide the basis for the with project condition. Analysis of the with project condition considers recreation opportunities that will be diminished in quality or quantity because of project development and operation. This will be accomplished in assessing the use of the proposed recreation development.

6-9**3**. Evaluation Procedure: General. Use the following procedure to determine the benefit from recreation resource use with a plan or project. (See Figure 6-8) The benefit is based on the gross value

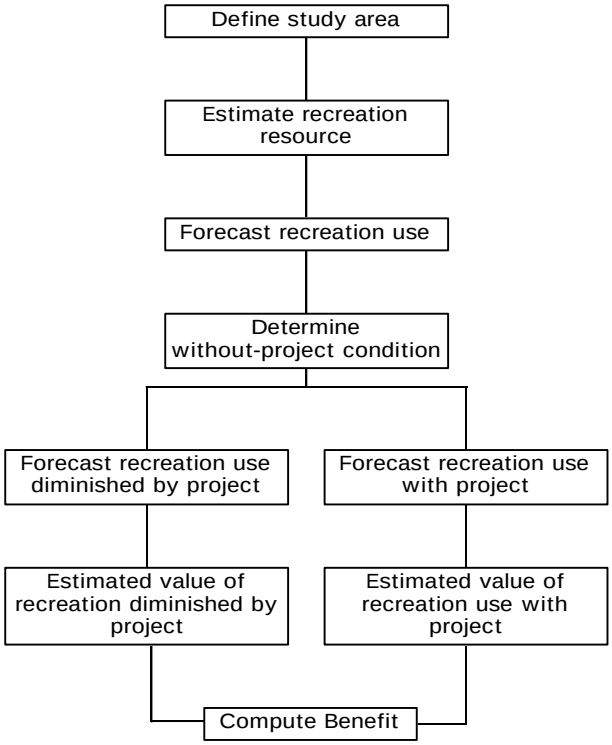


Figure 6-8. Flowchart of Recreation Benefit Evaluation Procedures

of recreation use of the resource for the with project condition less the gross loss in recreation use caused by the project or plan. The recreation benefit is measured in nine steps. The level of effort expended on each step depends on the nature of the proposed improvement, the state of the art for accurately refining the estimate, and the sensitivity or project formulation and justification to further refinement.

6-9**4**. Evaluation Procedure: Define the Study Area. Determine changes in recreation use and value resulting from alternative plans through the analysis of without project and with project conditions in the study area over the prescribed period of analysis. The impacts should relate to the geographical recreation "market" defined by the location of actual and potential user populations. Definition of the study area should be justified with respect to the particular characteristics and quality of the site and the availability of similar alternative recreation opportunities. Reference to statistical evidence regarding the spatial distribution of trip generation is encouraged.

6-9**5**. Evaluation Procedure: Estimate Recreation Resource.

a. Include in estimates of the recreation resource capacity for the study area all sites (see paragraph 6-9**2**b) that provide recreation activities similar to those displaced or provided by the project. The recreation resource in the study area is the system of water and related land recreation sites that influence the demand for the proposed project and are influenced in turn by the demand at the existing site.

b. Include in the inventory of water and related land recreation sites in this study area those Federal, State, county, local, and private sites that are in varying stages of development or that are authorized and likely to be developed in the forecast period.

c. Identify the ability of recreation alternatives to provide different recreation activities and assess the quality of the alternative recreation experiences.

6-9**6**. Evaluation Procedure: Forecast Potential Recreation Use in the Study Area. Potential use is the expected visitation at prevailing prices unconstrained by supply. Forecast of total recreation use in the study area should be made for each activity currently provided at the project site and for each activity proposed in the plan or project. The potential use for a specified outdoor water and related land recreation activity will depend on the size and characteristics of the study area population and the availability of the specified recreation activity and other types of recreation in the study area.

a. The recreation use of the site's resources will depend not only on the attributes of the site and its proximity to population centers, but also on its location in relation to the location of other water and related land resources providing similar or complementary types of recreation with the study area.

b. Forecasting potential future participation in recreation activities for the study area involves four steps: (1) Collect data on explanatory variables that influence the demand for recreation activities; (2) Relate potential use to these variables by means of some use estimating techniques as described in paragraph 6-9**8**; (3) Forecast values of the explanatory variables over the period of analysis. Justify projections and explain any simplifying assumptions. Reference to statistical evidence on trends in encouraged; (4) Calculate expected use for the study area using the values obtained in Step (3) and the relationships determined in Step (2).

6-9**7**. Evaluation Procedure: Determine the Without Project Condition. Determine the without project condition for the study area on the basis of a comparison of the available recreation resources as specified in paragraph 6-9**5** and the recreation resource use as specified in paragraph 6-9**6** for each activity currently provided at the project site and each activity proposed in the plan or project. Compare the capacities of all sites, including the site without the proposed project, to produce recreation activities with the expected demand for each activity.

6-9**8**. Evaluation Procedure: Forecast Recreation Use With Project.

a. General. Forecast recreation use with the project as a basis for estimating project recreation values. Project use over time by calculating the change in use induced by anticipated changes in the variables that determine use. Explain values employed for projecting future demand and any simplifying assumptions. For the capacity method described in paragraph 6-9**8**b(4), use is constant over time as determined by the capacity constraint. Explain use projections and any simplifying assumptions. Reference to statistical projections of recreation participation is encouraged.

b. Use Estimating Techniques. Use one or more of the following approaches for estimating recreation use for the with project and/or without project conditions. The use of any other method should be justified as conforming to the characteristics listed in paragraph 6-9**1**b. References to statistical estimates are encouraged.

(1) Regional use estimating models. Regional use estimating models are statistical models that relate use to the relevant determinants based on data from existing recreation sites in the study area. The use of regional models can economize on resources required for site-specific studies. In the absence of a regional model, estimate use by one of the site-specific methods described below. If a use estimating model has already been developed for the region in which a proposed project is to be located, use estimates should be obtained by the following procedure:

(a) Delimit the areas of origin for the proposed project (use of counties or parts of counties as origin areas will facilitate gathering of data in subsequent steps).

(b) Compute measures of the explanatory variables in the use equation for each origin area and for each year for which an estimate is required.

(c) Calculate use from each area for each year.

(d) Aggregate use from each area to get estimated annual use.

(2) Site-specific use estimating models. The preferred site-specific method of estimating use is a use estimating model (UEM) that relates use per 1,000 of origin population to distance traveled, socioeconomic factors, and characteristics of the site and alternative recreation opportunities. Use estimating models yield regression coefficients estimated from data gathered at a comparable existing site or cross section of existing sites. The coefficients are used to estimate visitation at a proposed site in the same way as described for regional models. Factors that influence demand for recreation, such as characteristics of user populations and availability of alternative opportunities, are explicitly taken into account by variables in the model. Because of the influence of congestion during heavy use periods, it is desirable to distinguish use during summer weekends and holidays. If data limitations do not permit disaggregation, explain treatment of seasonal use variation and any simplifying assumptions.

(3) Application of information from a similar project.

(a) If a UEM is not available and cannot be estimated because of data limitations, use may be estimated by the similar project method. This method assumes that recreation demand for a proposed project can be estimated from observations of visitation patterns at one or more existing projects with similar resource, operations, and use characteristics. The alternatives under study are compared with water resource projects and recreation resource areas for which trip generation and other statistics are known. It is important to obtain as close a match as possible in type, size, and quality of project; market area demographic and socioeconomic characteristics; existence and location of competing recreation opportunities; and other variables that influence demand.

(b) The most efficient and technically sound similar project procedure is based on per capita use curves (i.e., regression curves relating per capita rate of use to travel distance) from which use estimates are derived. The similar project method involves the following steps:

(1) Evaluate the characteristics of a proposed project or other area under study.

(2) Select a similar project or area by comparing characteristics of the proposed project with available information for existing sites; include evaluation and comparison of the respective recreation market areas.

(3) Adjust the per capita use curve to account for the differences between the similar project and the proposed project.

(4) Determine the county populations within the market area for the years in question, and derive per capita use rates for each county population by measuring road mile distance from the project to the center of the most populated city within the county (proxy for centroid of county population).

(5) Multiply each county per capita rate by county population and sum to get total use.

(6) Determine the percentage of total use that the foregoing estimate represents; if 100 percent, use as is; if less, adjust accordingly.

(c) Justify assumptions used to adjust or modify per capita use curves.

(4) Capacity method of determining use. If data on use determining variables are unavailable and are not cost effective to obtain, and if it can be demonstrated that sufficient excess demand exists in the market area to accommodate the additional capacity supplied by a proposed project, use may be assumed to be equal to capacity. Since this method provides no information on trip generation, willingness to pay cannot be evaluated by the travel cost method.

6-9**9**. Evaluation Procedure: Estimate Value of Use With the Project. As noted in paragraph 6-9**1**, three alternative methods can be used to estimate recreation benefits:

a. Travel Cost Estimate of Willingness To Pay Based on Use Estimating Model or Per Capita Use Curves.

(1) Conditions under which TCM may not be used.

(a) Use was not estimated by a technique relating trip-generation to distance to the site;

(b) There is insufficient variation in travel distances to allow parameter estimation (for example, urban sites); or

(c) The project site is typically only one of several destinations visited on a single trip.

(2) Construction of a TCM demand curve. The area under a demand curve based on travel costs to a site approximates the willingness to pay for access to the recreation opportunities there. This estimate involves the following calculations:

(a) Convert round-trip distance from each origin into monetary values by suing the most recent U.S. Department of Transportation average variable costs in cents per mile to operate an automobile, plus the opportunity cost of leisure time spent in travel and on the site. Time costs vary according to the alternative uses of time available to visitors and are correlated with income, age, education, occupation, time of year, and day of week. Explain values assigned to time and any simplifying assumptions.

(b) Construct a demand curve that relates "prices" to total visits. Given a relationship between travel costs and annual visitation from a use estimating model or a per capita use curve, construct a demand curve by gradually increasing travel cost and calculating the total visitation associated with each increase, until visitation falls to zero for all origins.

(c) Compute the area under the demand curve plus any user charges or entrance fees. This value measures the annual total willingness to pay for recreation activities available at the site.

(d) Discussion of travel cost method can be found in paragraphs 6-10**4** through 6-10**7** of this section and is provided for background information. Development and use of techniques more refined than those presented are encouraged.

b. Contingent Valuation (Survey) Estimate of Willingness To Pay.

(1) Use of contingent valuation method for daily or annual values. CVM may obtain either daily or annual estimates of willingness to pay. Multiply daily estimates by annual use obtained previously. Annual estimates do not require use estimation except to demonstrate the net increase in recreation use in the market area.

(2) Designing and using simulated markets to identify the value of recreational resources as if actual markets existed. Five steps are involved:

(a) Establish a market to the respondent.

(b) Permit the respondent to use the market to make trades and establish prices or values reflecting the respondent's individual evaluation of the recreation opportunities bought or sold.

(c) Treat the values reported by the respondent of individual values for recreation, contingent upon the existence of the market.

(d) Given willingness to pay bids from an unbiased sample of users in the market area, the socioeconomic characteristics of respondents, distance to the site, and available alternative recreation opportunities for each origin, obtain multiple regression estimates of average household value for the proposed change in recreation opportunities for households in each group.

(e) Multiply this value by the number of households in the group and sum the group values to estimate the aggregate willingness to pay if the average values are annual; multiply this value by estimated annual use if average values are daily.

(3) Obtaining individual bids from personal interviews or mail surveys. The preferred format is one in which the respondent is required to answer "yes" or "no" to questions if he or she is willing to pay a stated amount of money to obtain a stated increment in annual recreation opportunities. The value is increased gradually until the highest amount that the respondent is willing to pay is identified. Examples of question formats and further discussion of survey techniques can be found in paragraphs 6-10**8** through 6-11**2** of this section and is provided for background information. Development and use of techniques more refined than those presented are encouraged.

(4) Developing regional contingent valuation models. Regional models may be developed with CVM as well as use estimating models. All survey forms are subject to the clearance procedures of the Office of Management and Budget.

c. Unit Day Value Approximation of Willingness To Pay.

(1) Application of unit day values. See paragraph 6-9**1**c(3) **and 6-91d**.

(2) Selection of value.

(a) If the UDV method is used for economic evaluations, select a specific value from the range of values agreed to by Federal water resource agencies. The product of the selected value times the difference in estimated annual use over the project life relative to the without project condition provides the estimate of recreation benefits.

(1) If evidence indicates that a value outside the agreed-to range is more accurate, a regional model or site-specific study should be conducted. Explain the selection of any particular value within the published range.

(2) To explain the selection of a specific value, a point rating method may be used to reflect quality, relative scarcity, ease of access, and esthetic features. Appropriate use should be made of studies of preferences, user satisfaction, and willingness to pay for different characteristics; particular efforts should be made to use estimates derived elsewhere from applications of the TCM and CVM techniques.

(b) Account for site transfers in choosing unit day values. Examples of a point rating table that do this can be found at Tables 6-29 and 6-30, and further discussion of unit day value selection can

be found in paragraphs 6-11**3** through 6-11**6** of this section and is provided for background information. Development and use of techniques more refined than those presented are encouraged.

6-**100**. Evaluation Procedure: Forecast Recreation Use Diminished With Project. Using the appropriate method described in paragraph 6-9**8**, forecast the recreation resource sues that would be diminished due to physical displacement expected because of the plan or project.

6-10**1**. Evaluation Procedure: Estimate Value of Recreation Use Diminished With Project. Using the appropriate methods described in paragraph 6-9**9** and selected by the appropriate criteria described in paragraph 6-9**1**, estimate the value of the recreation uses that would be diminished by the physical displacement expected to occur as a result of the plan or project. In determining project net benefits, account for changes in recreation use of an existing resource and/or project as a result of transfers to the plan or project under study.

6-10**2**. Evaluation Procedure: Compute Net Project Benefits. Compute the project benefit as the difference between the gross value of recreation use as estimated in paragraph 6-9**8** and the value of recreation use diminished as estimated in paragraph 6-10**1**. However, if excess capacity for any activity exists in the study area, benefits are the user cost savings plus the value of any qualitative differences in recreation.

6-10**3**. Report and Display Procedures. Tables 6-22 and 6-23 are suggested presentations for reports that include recreation as a purpose.

Table 6-22
Recreation Capacity and Use (19__)[1]

	Without project			With project		
	Capacity	Use	Surplus or Deficit	Capacity	Gross use	Displaced use
Plan 1						
Plan 2						
Plan 3						
Plan 4						

[1]Prepare for representative project years.

Table 6-23
Annualized Recreation Benefits, Recommended Plan

	Value of gross use	Value of displaced use	Net value
Specialized			
General			

6-10**4**. Travel Cost Method (Supplementary Information): Overview. The basic premise of the travel cost method (TCM) is that per capita use of a recreation site will decrease as the out-of-pocket and time costs of traveling from place of origin to the site increase, other things remaining equal. The method consists of deriving a demand curve for a recreation site by using the variable costs of travel and the value of time as proxies for price. By use of data collected from users of existing sites, the travel cost method permits development of:

a. Estimated use of the proposed site.

b. A per capita demand function for recreation at the site.

c. An estimate of the NED recreation benefits of the site. The travel cost procedure consists of two steps: estimating use and deriving a demand curve.

6-10**5**. Travel Cost Method: Estimating Use.

a. Use Estimating Models.

(1) The preferred method for estimating use is a use estimating model (UEM) that relates use at a proposed site to distance traveled, socioeconomic factors, and characteristics of the site and alternative recreation opportunities. Use estimating models are based on data gathered at an existing site or on a cross section of existing sites with the resultant statistical coefficients used to estimate use at a proposed site. Factors that influence demand for recreation, such as characteristics of user populations and availability of alternative opportunities, are explicitly taken into account by variables in the model.

(2) Application of an existing UEM to a proposed site involves the following steps:

(a) Identify the areas of origin for the proposed project (use of counties or parts of counties as origin areas facilitates gathering of data in subsequent steps).

(b) Compute measures of the explanatory variables in the use equation for each origin area and for each year an estimate is required.

© Calculate use from each area and for each year.

(d) Aggregate use from each area to get estimated annual use.

b. Similar Project Use Estimation.

(1) The similar project procedure is based on the concept that recreation demand for a proposed project can be estimated by observing the visitation patterns at one or more existing projects with similar resource, operation, and anticipated recreation-use characteristics. The procedure involves the graphic or statistical matching of the recreation site alternatives under study with existing water resource projects and recreation resource areas for which use statistics and other information are known. The objective of the similar project procedure is to obtain as close a match as possible in type, size, and quality of project; market area demographic and socioeconomic characteristics; the existence and location of competing recreation opportunities; and other demand influencing variables.

(2) The most efficient and technically sound similar project procedure is based on per capita use curves (i.e., regression curve relating per capita rate of use to travel distance) from which use estimates are derived. Per capita use curves have been estimated for 52 existing reservoirs. An overview of the methodology adapted from Brown, et al., is provided below.

(3) Briefly stated, use of the similar project prediction method involves the following steps:

(a) Evaluate the characteristics of a proposed project or area under study.

(b) Select a similar project or area by comparing characteristics of the proposed project with available information for existing sites; include evaluation and comparison of the respective recreation market areas.

(c) Adjust the per capita use curve to account for the differences between the similar project and the proposed project.

(d) Determine the county populations within the market area for the year in question and derive per capita use rates for each county population by measuring road-mile distance from the project to the center of the most populated city within the county (proxy for centroid of county population).

(e) Multiply the contribution from each county per capita rate by county population, and sum to get total use.

(f) Determine the percentage of total use that the foregoing estimate represents. If 100 percent, use as is; if less, adjust accordingly.

(4) A critical shortcoming of this similar project method is the subjectivity inherent in the manual adjustment of the per capita use curve required to account for demand factors other than travel distance. The reliability of the method can be enhanced through experience, but it cannot be expected to approach the reliability of the more sophisticated statistical models.

6-10**6**. Travel Cost Method: Deriving Demand.

a. The travel cost method is based on the correspondence between increasing the distance from areas of origin to the site and increasing the cost or price of recreation at the site. the second step of the procedure consists of calculating total use at different incremental distances (prices); it is based directly on use estimator models or per capita use curves. The result is a demand curve for the site being evaluated that relates "prices" to total visits. Distances are converted to dollar values using per mile conversion factors reflecting both time and out-of-pocket travel costs. The area under the demand curve plus any user charges or entrance fees measure the recreation benefits attributable to the site. The procedure is described in detail below.

b. The estimate of recreation use for a project derived from application of a per capita use curve or UEM model yields an initial point on a resource's demand curve. This point is the quantity of use that would be demanded at a zero price. For example, assume that the appropriate per capita use rates have been estimated as indicated in Table 6-24.

c. This estimate of 35,000 yields an initial point on the resource's demand curve. To find sufficient points to determine the entire demand curve, it is necessary to make small incremental increases in the price of participation and to measure the quantity of use that would be demanded given these chances. This is equivalent to moving the project farther and farther from the potential users, requiring them to pay more and more in travel costs. As the simulated distance increases, use decreases, and for each increment in distance a new use estimate is computed using either the use estimating model or the per capita use curve. the new use estimates are the various quantities of recreation that would be demanded at increasing prices.

d. For example, assume that an increment of 10 miles in travel distance is used to simulate an increase in cost for the proposed project described above. The use estimate of use would then be as indicated in Table 6-25.

e. This would be a second point on the resource's demand curve; the quantity demanded (21,000 visits) at a price equivalent to the travel cost associated with an increment in distance of 10 miles. (A discussion of the proxy for price used to assign a dollar value to this increment is in paragraph 6-10**6**f(1).)

f. Remaining points on the resource demand survey are then estimated by making continued increments in the price (simulated increases in distance) until the anticipated visitation from all areas of origin is zero. In the example above using 10-mile increments, the visitation expected with simulated increases in distance would be as indicated in Table 6-26.

(1) Proxy for price.

(a) To determine the price at which the various quantities of use are demanded, the incremental increases in distance are simply converted into the costs that would be incurred by the recreation users if they were required to travel the additional mileage. The variable or out-of-pocket travel costs are used as the proxy for price, since these are the costs that potential users would be most aware of when making a decision about whether to visit a particular resource area.

(b) The conversion of mileage to price should use the most current published results of studies conducted periodically by the U.S. Department of Transportation concerning the average cost of operating an automobile. As an example, average variable cost estimates for 1976 are summarized in Table 6-27 (U.S. Department of Transportation, 1977).

(c) The variable cost reflects the average out-of-pocket cost per mile to operate various types of automobiles. It does not include such fixed costs as depreciation, insurance, and registration, since those costs would generally not affect the potential user's decision to travel the additional mileage for recreation purposes.

(d) Two adjustments are required, however, before this cost can be used as the proxy for price. The first is an adjustment for round-trip mileage. The distance measure used in the per capita use curve or regional estimator is one-way mileage, while the recreation user must incur the variable costs

Table 6-24
Zero Price Quantity

Origin	Population	Distance	Visits per capita	Estimated visitation
A	10,000	10	3	30,000
B.....	1,000	20	2	2,000
C	3,000	30	1	3,000
Total				35,000

Table 6-25
Ten Mile Increment Quantity

Origin	Population	Simulated distance (Actual 10)	Visits per capita	Estimated visitation
A	10,000	20	2	20,000
B.....	1,000	30	1	1,000
C	3,000	40	0	0
Total				21,000

Table 6-26
Estimated Visitation

Origin	0	10 Miles	20 Miles	30 Miles
A	30,000	20,000	10,000	0
B.....	2,000	1,000	0	0
C	3,000	0	0	0
Total	35,000	21,000	10,000	0

Table 6-27
Average Variable Costs, in Cents Per Mile, to
Operate an Automobile

Variable Cost Category	Automobile type			
	Standard	Compact	Sub-compact	Average
Maintenance, accessories, parts, and tires.....	4.2	3.4	3.1	3.6
Gasoline and oil.....	3.2	2.5	1.8	2.5
Taxes on gasoline, oil, and				

tires.....	0.9	0.6	0.5	0.7
Total	8.4	6.5	5.4	6.8

while traveling to and from the project, so the cost per mile is doubled. Since more than one user may arrive in each vehicle, a second adjustment must be made to distribute the travel costs of the trip between the number of users traveling in each vehicle. This is readily accomplished by using the average number of users per vehicle determined from the survey of the existing sites sued to develop the per capita use curve or regional estimator.

(e) The variable travel costs are the proxy for price associated with the simulated increase in distance used to derive the resource demand curve. Using the average variable cost for all three types of automobiles (6.8 cents per mile) and using a hypothetical average of 2.7 persons per vehicle, the proxy for price for a simulated increase in distance of 10 miles in the above example would be equal to $0.50 (6.8 cents per mile times 2 for round-trip mileage, divided by 2.7 persons per vehicle, times 10-mile increment).

(2) An adjustment for the opportunity cost of time.

(a) The use of variable travel costs alone in the development of the demand schedules ignores the effects of time on recreation decisions. If time is ignored, the demand schedules are constructed under the hypothesis that increasing distance decreases use only because of higher money cost. However, the additional time required to travel the increased distance would seem to be a deterrent equal to or greater than the out-of-pocket money costs. The exclusion of the time factor introduces a bias into the derived demand schedule, shifting it to the left of the true demand schedule and resulting in an underestimation of the recreation benefits.

(b) The opportunity cost of time is the value of work or leisure activities foregone to travel to and recreate at the site. The opportunity cost for a person whose work time is variable is measured as income foregone during the recreation visit and associated travel. Most people, however, are constrained by a fixed work week and receive paid vacation days. Recreation occurring during periods where no working time is lost incurs only leisure time costs. This value may range between 0 (if the recreationist would not have engaged in any other leisure activity in the absence of the observed recreation) and the wage rate (if the alternative leisure activity was valuable enough to forego earnings, given that opportunity).

(c) Where direct survey data on time costs are not available, published statistics or studies of work-leisure choices and wage rates may be used to justify particular assumed values. One procedure that may be used to accommodate the disutility of time is to assume a known tradeoff between time and money; however, but no universally accepted formulation of this tradeoff has been established and empirically tested. In one proposed formulation, time is valued as one-third the average wage rate in the county of origin for adults and one-fourth of the adult value (one-twelfth of the wage rate) for children. Any method used to value time should be supported by documenting evidence. Both travel and onsite time costs should be included in the derivation of total willingness to pay for access to the site. **[Additional information on the calculation of time costs is provided in paragraph 6-159.]**

(3) Benefit computation.

(a) The final computational step in the travel cost approach is to measure the area under the demand curve. This area is equal to the amount users would be willing to pay but do not have to pay for the opportunity to participate in recreation at the resource being evaluated. Any user charges or entrance fees should be added to this value to determine the gross value of the resource associated with the specified management option.

(b) The travel cost approach can be used for evaluating either the with project or without project conditions as long as a use estimating model or a per capita use curve is available for estimating use under the specified condition. To evaluate the without project condition, estimate the value of the recreation that would be lost at a site if a water resource development project were developed. To evaluate a with project alternative, estimate the value of the new recreation opportunities that would be created. If a use estimator is not available for evaluating either the without project conditions or one of the with project conditions, the techniques described in other portions of this manual should be used.

(c) The procedure described above is applicable to any type of activity or groups of activities for which use can be described by a use estimating equation or per capita use curve. The separation of day use from overnight use or sightseeing from other day use activities, for example, is dependent upon the specificity of the survey data and the model formulation.

6-10**7**. Travel Cost Method: Data Requirements.

a. The development of use estimator models as described above requires that data from existing areas be systematically collected. The major requirement is that the data on use and users of a range of facility types and locations span the proposed types and locations for which estimates are to be made. A series of surveys at existing sites can provide such basic data, which would normally include total use, timing and patterns of use, characteristics or users, and users' areas of origin.

b. Methods of data collection that have proved fairly satisfactory involve a short handout questionnaire or interviews of a small sample of randomly selected users of the different recreation areas. It is important that reliable total visit statistics be obtained for each existing area being investigated. This can usually be done satisfactorily with judicious use of traffic counters at most water-based recreation areas. If totals are collected throughout the season, samples for questionnaires or interviews need be drawn only on a few days--on both weekends and weekdays, as patterns are likely to vary greatly between them.

c. The number of questions asked may also be limited. The major concerns are the origin and purpose of the trip and limited information about the users. A representative range of areas, facilities, and locational proximities should be covered in such surveys. Fully adequate methods that are relatively inexpensive, entail a minimum of difficulty at the site and to the user, and yield meaningful results are available.

6-10**8**. Contingent Valuation (Survey) Methods (Supplementary Information): Overview.

a. Contingent valuation methods (CVMs) obtain estimates of changes in NED benefits by directly asking individuals about their willingness to pay (WTP) for changes in quantity of recreation at a particular site. Individual values may be aggregated by summing the WTPs for all users in the area.

b. Contingent valuation methods consist of designing and using simulated markets to identify the value of recreation just as actual markets would, if they existed. Three basic steps are involved:

(1) The analyst establishes a market to the respondent.

(2) He permits the respondent to "use" the market to make "trades" and to establish prices or values that reflect the respondent's individual valuation of the recreation opportunities "bought" or "sold".

(3) The analyst treats the values reported by the respondent as individual values for the recreation, contingent upon the existence of the described market. the respondent's bids are sued with the data contained in the market description (step 1) to estimate the aggregate value of the recreation being studied.

c. Contingent valuation methods are particularly appropriate for evaluating projects likely to be one of several destinations on a single trip and projects that will result in a relatively small change in the quality of recreation at a site. Contingent value results may be adversely affected unless questions are carefully designed and pretested to avoid several possible kinds of response bias. Several techniques are available for obtaining the individual bids, which are the basic data for CVM.

6-10**9**. Contingent Valuation Methods: Iterative Bidding Formats.

a. Iterative bidding surveys ask the respondent to react to a series of values posed by the enumerator. Following establishment of the market and a complete description of the recreational good, service, or amenity to be valued, the respondent is asked to answer "yes" or "no" to whether he is willing to pay the stated amount of money to obtain the stated increment in recreation. The enumerator iteratively varies the value posed until he identifies the highest amount the respondent is willing to pay. This amount is the respondent's "bid" for the specified increment in recreation.

b. Iterative bidding techniques are most effective in personal interviews. Mail survey formats have also been used in research studies. These typically ask the respondent to answer "yes" or "no" to a small number of specified values in iterative questions and, finally, ask an open-ended question: "Now, write down the maximum amount you will be willing to pay. $_____." At present, mail survey applications of the iterative bidding technique have not been adequately tested and cannot be recommended.

c. The recreation facilities to be evaluated will be described in quantity, quality, time, and location dimensions. These descriptions should be hypothetical in the sense that they do not precisely describe features of actual sites or proposed projects, but they should be precise enough to give the respondent adequate information on which to base a valuation. To permit estimation of regional models, quantity, quality, and location dimensions should be varied and the iterative bidding exercise repeated. Verbal descriptions should be precise, and, when practicable, pertinent aspects of the facilities should be displayed or depicted nonverbally (e.g., with photographs, drawings, motion pictures, scale models).

d. In most cases, the good to be valued is "the right to use (the recreation facility) for one year." The responses obtained are thus annual measures of the individual's willingness to pay for a given increment or decrement in recreation opportunities. Bidding formats that define the good in some

other terms (e.g., day of use, trip) can also be used in some applications as long as appropriate estimates of numbers of days of use and trips are available to permit calculation of annual values.

e. The institutional rules pertaining to the hypothetical market will be described in sufficient detail so that the respondent knows his rights and the rights of all others in the market. These rules should be realistic and credible, they should place the respondent in a role and encourage market behavior with which he is familiar, and they should be of a kind generally viewed as just, fair, and ethically sound. They should be nonthreatening. Formats that threaten the respondent with a welfare shock that he may view as unfair should be avoided.

f. The method of payment (called payment vehicles) should be carefully pretested. At the pretest stage, always include a neutral vehicle, e.g., "The money collected will be placed in a trust fund and devoted entirely to providing (the good)."

g. The respondent should be given price or value information and asked, "Would you buy?" with the clear understanding that if no, you would go without." The wording "Would you be willing to pay * * * ? " should be avoided because some respondents may interpret it as an appeal for voluntary contributions. The question must be worded to suggest the pragmatic "take it, or leave it" atmosphere of the marketplace.

h. Depending on the "yes" or "no" answer, the price or value is varied iteratively and the question repeated until the respondent's point of indifference between the money and the good is identified. Early iterations may change the price widely until the enumerator senses that he is approaching the respondent's indifference point; then iterative price variations will become finer.

I. The starting price quote (called "starting point") will vary across respondents. The particular starting point assigned to a given respondent will be chosen randomly.

j. The payment vehicle should be specified. Payment vehicles that may generate an emotional reaction should be avoided because they might introduce a confusing element into the bid data. Vehicles based on increments in taxes, utility bills, and hunting or fishing license fees may generate such reactions.

k. General formats for iterative bidding questions are presented below, followed by specific examples. The questions must be specific to the particular measure of value to be elicited from the respondent. WTP formats should always be used; they may be incremental (willingness to pay for an increment in a desired recreation opportunity) or decremental (willingness to pay to avoid a threatened decrement in a desired recreation opportunity). The incremental format has two major advantages: it is the theoretically correct measure and, since it offers the respondent the (hypothetical) chance to pay for a desired good, it is unlikely to provoke an offended reaction. The decremental format, which asks the respondent how much he would pay to avoid a change he does not want, may seem unfair or morally offensive to some, and thus may elicit biased or otherwise unreliable value estimates. The incremental version is preferred wherever it is credible.

l. The incremental version may not be credible if the real world experience is typically one of decrements rather than increments. For example, the question "if a new, unspoiled natural recreation environment could be created and the right to use it would cost $_____, would you buy?" may be rejected as fantasy by some respondents in a world in which "unspoiled natural recreation environments" are fast disappearing. In such circumstances, it may be necessary to resort to

decremental formats. However, since reasonable doubts can be raised, a priori, about the efficiency of WTP decremental formats, the following precautions are essential: The format designed must be the most consistent and plausible and least offensive possible; and at least two different formats must be pretested to permit statistical testing for differences in their performance.

m. General examples of the WTP formats are:

(1) WTP incremental: "If you had the opportunity to obtain [describe an increment in recreation facilities, hypothetical market rules, and payment vehicle], would you pay [starting price]? Yes (pay) _____. Or would you refuse to pay, and do without [the increment]? No (pay) ____." Reiterate with new prices until the highest price eliciting a "yes" response is identified.

(2) WTP decremental (example a): "[Describe a decrement in recreation facilities] will occur unless [describe market rules and payment vehicle]. Would you pay [starting price] to avoid [the decrement]? Yes (pay) _____. Or would you refuse to pay, and thus permit [the decrement]? No (pay) _____."

(3) WTP decremental (example b): "[Describe a recreation facility currently available to respondent] is currently available [describe existing market rules, existing payment vehicle, and existing price]. Unless [the existing price] is increased, [describe a decrement] will occur. Would you pay [starting price, which is some increment over the existing price] in order to prevent [the decrement]? Yes (pay) _____. Or would you refuse to pay, and thus permit [the decrement]? No (pay) _____." Reiterate. . . .

n. Since some respondents may bid only zero amounts to WTP questions, it is important to identify which zero bids represent true zero valuations and which, if any, represent a protest against the market rules or payment vehicles in the bidding format. Check questions should always be used to probe "zero" responses to WTP formats, e.g., "Did you bid zero because (check one):

(1) You believe [the stated increment] would be worth nothing to you?

(2) You believe [the payment vehicle] is already too high?

(3) You believe [the stated increment] would be of value, but you do not think it is fair to expect (the respondent's class of citizen, e.g., hunting license holders, utility customers) to pay for it?

o. Answers (2) and (3) above are "protest" responses, addressed not to the value of the good but to some element of the question format. Protest bids should be recorded but eliminated from calculations to estimate values. Formats that elicit more than 15 percent protest responses in pretests should be discarded, since a high incidence of protest bids may indicate that some nonzero bids are also distorted.

6-1**10**. Contingent Valuation Methods: Noniterative Bidding Formats.

a. Noniterative bidding formats are adaptable to implementation with mail surveys. There are two kinds of noniterative formats: close-ended, which ask respondents to answer "yes" or "no" to a single stated value; and open-ended, which ask the respondent to write down the maximum amount

he would be willing to pay. A variant of the open-ended format asks the respondent either to select his maximum WTP from a list of stated discrete values or to write down his maximum WTP. Noniterative bidding formats are unlikely to be as reliable as iterative formats.

b. Noniterative mail survey formats may be used only for analysis of small projects. These formats must, to the extent practicable, have the basic attributes of the personal interview formats described above. Survey instruments should include color photographs and, if appropriate, other nonverbal stimuli.

c. Open-ended bidding formats should be used with one half of the sample and close-ended formats with the other half. The bids obtained should be analyzed to determine if the format influences the results to a significant degree. Examples of these formats are presented below.

d. Open-ended. "Due to pressures of population growth and economic development, 10 miles of trout stream such as that shown in the accompanying photograph are likely to be converted to other uses (e.g., a reservoir) and thus lost for trout fishing. Assume that the only way to preserve this 10-mile stretch for trout fishing is for trout fishermen to agree to buy an annual pass to fish in that stream segment. The money collected would pay for preservation of the stream section. If the stream segment was ____ miles from your home, and you could expect to catch ____ trout in a typical day's fishing there, what is the maximum amount you would pay for the annual fishing pass? Answer: $_____ per year.

e. Close-ended. The information presented in the open- ended format does not change, but the final question reads: " * * * and an annual fishing pass costs $_____ (assign dollar amounts randomly to respondents), would you buy one? Answer: Yes--. No--."

6-11**1**. Contingent Valuation Methods: Use Estimation.

a. All of the contingent valuation procedures described above generate annual value estimates directly, instead of first generating values per user day and then estimates of expected user days. The "annual value estimation" procedure is superior because it is more reliable, it automatically corrects for the economic influence of existing recreation opportunities, and it is better adapted to estimating activity and existence values where both are important.

b. Contingent valuation formats can also be designed to estimate values per user day but can have questions worded in terms of a day's activity. In the case of proposed increments, great care must be taken to determine the respondent's valuation of a day at the proposed site, given the continued availability of existing sites. Estimates of use may be made either by collecting such information as part of the survey or by other approved methods.

c. To collect use information in the survey, proceed as follows:

(1) For decrements in recreation opportunities, ask (a): how many trips the household made (I) last year or (ii) in a typical year, if last year was unusual for any reason; (b) how many days the trip lasted; and © how many household members participated in each trip.

(2) For increments, ask (a): the same information as for decrements, but about existing recreation sites similar to the proposed increment. Then, if the proposed increment (described with

verbal and nonverbal stimuli) were available, (b) how many trips, for how long, and with how many family members for the proposed increment; and © how many trips, for how long, and with how many family members in total for both the existing and proposed sites.

6-11**2**. Contingent Valuation Methods: Using Contingent Valuation Methods. Contingent valuation methods can be used to develop value estimator models or to estimate recreation benefits for a specific proposed project. These two uses are discussed below.

a. Value Estimator Models.

(1) Value estimator models (VEMs) are statistical models of the relationships between the bid and selected characteristics of the site(s) and user populations. A typical model has the form:

$V_{jk} = F(E_k, D_{jk}, C_k, A_k, S_{jk}, Q_j, I_j)$

Where:

V_{jk} is the value to household k of the specified change in recreation opportunity at site j.

E_k is a vector of social and demographic variables pertaining to household k, typically including income, ethnicity, and education.

D_{jk} is distance from the home of k to site j.

C_k is a measure of the capacity use of the existing stock of recreation facilities similar to those at site j in the market area centered at k's home.

A_k is distance from the home of k to the nearest existing alternative facility offering recreation opportunities similar to those at site j.

S_{jk} is an index of the availability of substitute recreation facilities (e.g., ocean beach for reservoir beach) in the market area centered at k's home.

Q_j is a vector of variables describing the quality of recreation at site j.

I_j is the increment or decrement in recreation at site j specified in the contingent valuation mechanism.

(2) This method has several desirable characteristics: (a) The Vjk are current WTP estimates of value for increments and decrements in recreation opportunity; (b) the V_j are annual values of the existence of the recreation facilities at site j, and thus replace user days and unit day values; © the V_{jk} are not arbitrarily set at the same daily value for all users, as are unit day values; (d) the variables in vector Q_j provide a systematic statistical basis for estimating how Vj varies with site quality; (e) the variables C_k, S_{jk}, and A_k provide a systematic statistical basis for adjusting V_j to account for competing and substitute facilities.

(3) Estimating a value estimator model requires the following steps:

(a) The final bids, after any calculations necessary to convert them to annual or daily household values, serve as the observations of the dependent variable.

(b) The observations of demographic variables serve as observations for the first set of independent variables.

(c) Existing recreation resource inventories and planning data provide the basis for specifying the second set of independent variables, i.e., those describing the existing stock of recreation opportunities. The location of each respondent's home is recorded on the completed survey instrument, and, together with the inventory and planning data for existing resources, permits calculation of individual observations of those variables that relate the existing stock of recreation opportunities to the location of the respondent's home. To complete the task of specifying these variables, some indices of the availability and quality of the existing recreation stock must be developed. These include indices of facilities and conveniences, and of site quality, especially esthetic quality.

(d) Site-specific descriptors serve as the third and final set of independent observations. These are the data presented to the respondent and upon which he based each of his bids. The estimated esthetic score of each photograph used in the bidding process serves as one of these site-specific descriptors. Other descriptors are the information presented to the respondent on size, distance, etc.

(e) Using the best available econometric techniques, the equation is then estimated. The dependent variable is expressed in terms of annual value per household, eliminating the need for separate estimation of user-days and the mean value of a user- day.

(4) Using an existing VEM to estimate the recreation benefits of a proposed project involves the following steps:

(a) Determine the market area for the recreation services affected by the project. If the market area is expected to exceed 120 miles, document the reasons.

(b) Determine from census data the demographic characteristics of the market area population.

(c) Divide the market area into groups on the basis of demographic variables and distance from the proposed site. One such group might be "households headed by a male of (ethnic group) with 10 to 12 years of education and household income between $12,001 and $15,000 annually, living 51 to 75 miles from the site".

(d) Calculate separately for each market subarea the values of the variables describing existing recreation facilities obtained from inventory and planning data.

(e) Obtain from project planning data the values of the variables describing project-specific attributes.

(f) Use the specified data and the fitted model, to estimate the household value for the proposed increment or decrement in recreation opportunities for a typical household in each group.

(g) Multiply this value by the number of households in the group, and sum the group values to get the aggregate benefit estimate.

b. Applying CVM to a Specific Proposed Project. In some circumstances, CVMs may be used to estimate the recreation benefits of a specific proposed project. Great care must be taken in the design of the survey instruments and editing of the data, however, because some respondents may try to influence the outcome of the analysis by their bidding responses. The survey design and sampling requirements of such a study are discussed under "Data requirements" below.

c. Data Requirements.

(1) Survey design. For contingent valuation exercises, the survey instrument must contain two major sections: One for bidding formats and one for collecting appropriate demographic data; a brief final section should elicit respondent feedback. Since there is no reason to prohibit the use of additional sections, other data useful for recreation planning may be gathered during the interview. Additional sections may include recreation activities, attitudes, recreation preferences, and projected use of proposed new recreation facilities. To minimize inconvenience to respondents and to avoid respondent fatigue and lapses of concentration, the complete interview should typically not require more than 30 minutes.

(2) Pretesting.

(a) The basic survey instrument, including bidding formats and questions to collect additional data (e.g., demographic data, respondent's history of use of recreation facilities, etc.), must be pretested by using a sample of at least 30 respondents in order to generate a data set permitting appropriate statistical tests. The pretest sample should not be drawn from the same population as the actual study sample. Sampling procedures for the pretest are not especially crucial, but an attempt should be made to obtain a demographic cross section of users. A variety of bidding formats, hypothetical market designs, and payment vehicles should be pretested.

(b) Nonresponses and protest responses should be tabulated for all bidding formats. Those formats eliciting large proportions (i.e., more than 15 percent) of such responses should be eliminated or redesigned and retested. Statistical tests for information bias, vehicle bias, and starting point bias should be performed, and formats that generate any of these biases should be eliminated, or redesigned and retested.

(3) Sampling.

(a) Following pretesting and, if necessary, redesign, a sampling frame for the main survey should be drawn. The household is the basic sampling unit. For estimation of activity values, samples may be drawn from reliable lists of participants (e.g., fishing license holders), if available. For activity values where no such lists exist, and for existence values, the sample must be drawn from the regional population of households.

(b) Sampling procedures should have the performance characteristics of random sampling. To save travel time in a personal interview survey, randomized, cluster sampling is permissible, provided that no cluster is larger than one- thirtieth of the sample size. Sample size should be no fewer than 200 households. The respondent selected to answer on behalf of the household should preferably be the head-of-household or spouse of the head. In the absence of the head and spouse, another adult

member of the household may be interviewed, provided he or she has assumed a responsible life-role (e.g., is a parent or is financially self-supporting).

(c) Random sampling methods are also used for mail surveys. At least two followup mailings are necessary to reduce nonresponse. In addition, a random telephone survey of 10 percent of the nonresponses after the second followup mailing is necessary. The results of the telephone survey must be analyzed separately in order to permit testing for nonresponse bias.

(4) Specific proposed project requirements.

(a) Procedures for valuing recreation benefits using project-specific iterative bidding formats are similar, in some respects, to the procedures described above. Aspects that are different are highlighted in the following:

(b) The population to be sampled is that of the market area(s) for the various categories of recreation opportunities that would be beneficially or adversely affected. Survey instruments follow the basic format described above, with the major exception that the bidding formats provide site-specific information on the proposed project itself. Photographs and other stimuli should be focused on the without project condition for adverse effects and on the with project condition for beneficial effects. In the latter case, it may be necessary to use photographs of a completed similar project.

(c) Individual bid data must be used as observations to test carefully for biases, including vehicle bias, information bias, starting point bias, and strategic bias, using established statistical testing procedures. Evidence of bias should (I) lead to elimination of formats producing bias at the pretest stage, and (ii) lead to reporting of any bias remaining after all instrument redesign possibilities have been exhausted. Final bids are aggregated across the sample and then projected to the market area population. These "population aggregate bids" are then used as estimates of the total value, positive or negative, of the effects, beneficial or adverse, of the proposed increments or decrements in recreation opportunities. Net project recreation effects are calculated as in paragraph 6-111a(1).

6-11**3**. Unit Day Value Method (Supplementary Information): Overview. The unit day value (UDV) method for estimating recreation benefits relies on expert or informed opinion and judgment to approximate the average willingness to pay of users of Federal or Federally assisted recreation resources. If an agency can demonstrate that more reliable TCM or CVM estimates are either not feasible or not justified for the particular project under study, as discussed under applicability criteria, the UDB method may be used; by applying a carefully thought-out and adjusted unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits.

6-11**4**. Unit Day Value Method: Implementation.

a. When the UDV method is used for economic evaluations, planners will select a specific value from the range of values provided in the most current published schedule. Application of the selected value to estimated annual use over the project life, in the context of the with- and without-project framework of analysis, provides the estimate of recreation benefits.

b. Two categories of outdoor recreation days, general and specialized, may be differentiated for evaluation purposes. "General" refers to a recreation day involving primarily those activities that are

attractive to the majority of outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. "Specialized" refers to a recreation day involving those activities for which opportunities in general are limited, intensity of use is low, and a high degree of skill, knowledge, and appreciation of the activity by the user may often be involved.

c. Estimates of total recreation days of use for both categories, where applicable, will be developed. The general category comprises the great majority of all recreation activities associated with water projects, including swimming, picnicking, boating, and most warm water fishing. Activities less often associated with water projects, such as big game hunting and salmon fishing, are included in the specialized category. A separate range of values is provided in a conversion table (Table 6-28) for each category and for fishing and hunting to facilitate adoption of a point system in determining the applicable unit values for each individual project under consideration.

Table 6-28
Conversion of Points to Dollar Values

Activity categories	Point values										
	0	10	20	30	40	50	60	70	80	90	100
General recreation (Points from Table VIII-3-2)	2.52	2.99	3.31	3.78	4.72	5.35	5.83	6.14	6.77	7.24	7.56
General fishing and hunting (Points from Table VIII-3-2)	3.62	4.09	4.41	4.88	5.35	5.83	6.46	6.77	7.24	7.40	7.56
Specialized fishing and hunting (Points from Table VIII-3-3)	17.63	18.11	18.42	18.89	19.37	21.26	23.15	24.56	26.45	28.34	29.92
Specialized recreation other than fishing and hunting (Points from Table VIII-3-3)	10.23	10.86	11.65	12.60	13.38	15.12	16.69	20.15	23.46	26.77	29.92

Note - Values per EGM 97-03, post-97 values will be updated yearly in EGMs.

d. When employing this method to determine recreation benefits, select appropriate values from the range of values provided. If evidence indicates a value outside the published range, use the TCM or CVM method.

e. In every case, planners are expected to explain the selection of any particular value. To assist in explaining a specific value, a point rating method may be used. The method illustrated here contains five specific criteria and associated measurement standards designed to reflect quality, relative scarcity, ease of access, and esthetic features. Since the list of criteria and weights assigned may vary with the situation, public involvement should occur in the value determination process. Planners in the various agencies are also expected to make appropriate use of studies of preferences, user satisfaction, and willingness to pay for different characteristics. When these studies are used, particular efforts should be made to use estimates derived elsewhere from applications of the TCM and CVM techniques, to support the value selected.

(1) General recreation (Table 6-29). Activities in this category are those associated with relatively intensive development of access and facilities as compared to the specialized recreation category. Generally, progressively higher physical standards for each unit of carrying capacity is

involved in selecting higher unit values, and these may be accompanied by larger related nonproject costs.

(2) Specialized recreation (Table 6-30).

(a) This category includes those activities whose values are generally lowered, if not actually excluded, by the type of development that enhances activities in the general recreation category. Thus, extensive or low density use and development constitutes the higher end of this range of values (e.g., big game hunting and wilderness pack trips). Also included in the upper end of the range are relatively unique experiences such as inland and marine fishing for salmon and steelhead, white water boating and canoeing, and long-range boat cruises in areas of outstanding scenic value. Examples of activities to which values at the lower end of the range would be assigned include upland bird hunting and specialized nature photography.

(b) The unit day values to be used for both the general and specialized recreation categories should be further adjusted to reflect additional quality considerations expected to prevail at various project sites in various regions of the Nation, and weighted according to their importance to users. For example, a reservoir that is expected to carry a relatively heavy load of suspended silt or is expected to be used beyond optimum capacity would be less desirable, and therefore of lower unit value, than one that will have clear water and be less crowded.

(c) Hunting and fishing may be treated either as general recreation (Table 6-29) or specialized recreation (Table 6-30) depending upon whether it is associated with developed areas or back country areas, respectively. In either case, the recreation experience (criterion "a" in the tables) will be given points according to the additional consideration of the chances of success; the midpoint of the value range is associated with the region's average catch or bag. Other criteria may be modified if appropriately based on available evidence about the preferences and willingness to pay of hunters and fishermen for different recreation quality factors.

(d) The degree to which alternative nonproject opportunities are available to users is also considered in the assignment of values. Higher values should be assigned if the population to be served does not have existing water-oriented recreation opportunities. If water-oriented recreation opportunities are relatively abundant, as compared to other outdoor recreation opportunities, lower unit values should be assigned, even if a large number of visitations are expected at the proposed development.

(e) The choice of a unit day value must account for transfers to avoid double counting of benefits. The net value of a transfer of use from one site to another is the difference in unit day values for recreation at the two sites. If recreation activities at the two sites are comparable, travel cost savings are the only NED benefits associated with the transfer. Use at the site must therefore be desegregated according to the proportion of total estimated use that would not have occurred without the project and the proportion of total use that represents transfers from existing sites. The respective types of uses must then be assigned different daily values as indicated.

(3) Establishing specific values within each range. Unit values selected are to be considered net of all associated costs of both the users and others in using or providing these resources and related services. Agencies will be encouraged, through review procedures, demonstration projects, and educational workshops, to adopt the TCM and CVM techniques for project evaluations that would

otherwise have used UDVs. As agencies gradually adopt CVM and TCM and develop a more comprehensive set of regional models, reliance on the UDV can be expected to diminish.

6-11**5**. Unit Day Value Method: Estimating Use.

a. Using the ranges of values requires the study of estimates of annual use foregone and expected at recreation sites. Use can be estimated by a use estimating equation or per capita use curve as discussed above, but when these means are available, the second step of the travel cost method should generally be used instead of UDVs to derive the benefit.

b. The capacity method is an alternative method of estimating use, but it has severe limitations. The capacity procedure involves the estimation of annual recreation use under without project and with project conditions through the determination of resource or facility capacities (taking into consideration instantaneous rates of use, turnover rates, and weekly and seasonal patterns of use). Seasonal use patterns are dependent on climate and culture and probably account for the greatest variation in use estimates derived through this method. In general, annual use of outdoor recreation areas, particularly in rural locations and in areas with pronounced seasonal variation, is usually about 50 times the design load, which is the number of visitors to a recreation area or site on an average summer Sunday. In very inaccessible areas and in those known for more restricted seasonal use, the multiplier would be less; in urban settings or in areas with less pronounced seasonal use patterns, the multiplier would be greater. In any case, the actual estimation of use involves an analytical procedure using instantaneous capacities, daily turnover rates, and weekly and seasonal use patterns as specific data inputs.

c. Because the capacity method does not involve the estimation of site-specific demand, its use is valid only when it has been otherwise determined that sufficient demand exists in the market area of project alternatives to accommodate the calculated capacity. Its greatest potential is therefore in urban settings where sufficient demand obviously exists. Additionally, its use should be limited to small projects with (1) a facility orientation (as opposed to a resource attraction), and (2) restricted market areas that would tend to make the use of alternative use estimating procedures less useful or efficient.

6-11**6**. Unit Day Value Method: Calculating Values. The estimates of annual use are combined with the selected unit day values to get an estimate of annual recreation benefits. The value assigned to each activity or category of activities is multiplied by the number of recreation days estimated for that activity. The products are then summed to obtain the estimate of the total value of an alternative. Recreation days to be gained and lost or foregone as a result of a particular alternative are listed and valuated separately, not merely shown as net recreation days. Transfers of recreational users to or from existing sites in the region must be calculated, and the net regional gain or loss used in the final benefit estimated. Adequate information must appear in the discussion of the use estimation and valuation procedure or elsewhere in the report concerning the alternative being considered, so that the reader can derive a similar value for each activity.

Table 6-29
Guidelines for Assigning Points for General Recreation

Criteria	Judgment factors				
(a) Recreation experience[1]	Two general activities[2]	Several general activities	Several general activities: one high quality value activity[3]	Several general activities; more than one high quality high activity	Numerous high quality value activities; some general activities
Total Points: 30 Point Value:	0-4	5-10	11-16	17-13	24-30
(b) Availability of opportunity[4]	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 30 min. travel time	One or two within 1 hr. travel time; none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total Points: 18 Point Value:	0-3	4-6	7-10	11-14	15-18
(c) Carrying capacity[5]	Minimum facility for development for public health and safety	Basic facility to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total Points: 14 Point Value:	0-2	3-5	6-8	9-11	12-14
(d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site; limited access within site	Fair access, fair road to site; fair access, good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good access within site
Total Points: 18 Point Value:	0-3	4-6	7-10	11-14	15-18
(e) Environmental	Low esthetic factors[6] that significantly lower quality[7]	Average esthetic quality; factors exist that lower quality to minor degree	Above average esthetic quality; any limiting factors can be reasonably rectified	High esthetic quality; no factors exist that lower quality	Outstanding esthetic quality; no factors exist that lower quality
Total Points: 20 Point Value:	0-2	3-6	7-10	11-15	16-20

[1]Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
[2]General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.
[3]High quality value activities include those that are not common to the region and/or Nation, and that are usually of high quality.
[4]Likelihood of success at fishing and hunting.
[5]Value should be adjusted for overuse.
[6]Major esthetic qualities to be considered include geology and topography, water, and vegetation.
[7]Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

Table 6-30
Guidelines for Assigning Points for Special Recreation

Criteria	Judgment factors				
(a) Recreation experience[1] Total Points: 30 Point Value:	Heavy use or frequent crowding or other interference with use 0-4	Moderate use, other users evident and likely to interfere with use 5-10	Moderate use, some evidence of other users and occasional interference with use due to crowding 11-16	Usually little evidence of other users, rarely if ever crowded 17-13	Very low evidence of other users, never crowded 24-30
(b) Availability of opportunity[2] Total Points: 18 Point Value:	Several within 1 hr. travel time; a few within 30 min. travel time 0-3	Several within 1 hr. travel time; none within 30 min. travel time 4-6	One or two within 1 hr. travel time; none within 45 min. travel time 7-10	None within 1 hr. travel time 11-14	None within 2 hr. travel time 15-18
(c) Carrying capacity[3] Total Points: 14 Point Value:	Minimum facility for development for public health and safety 0-2	Basic facility to conduct activity(ies) 3-5	Adequate facilities to conduct without deterioration of the resource or activity experience 6-8	Optimum facilities to conduct activity at site potential 9-11	Ultimate facilities to achieve intent of selected alternative 12-14
(d) Accessibility Total Points: 18 Point Value:	Limited access by any means to site or within site 0-3	Fair access, poor quality roads to site; limited access within site 4-6	Fair access, fair road to site; fair access, good roads within site 7-10	Good access, good roads to site; fair access, good roads within site 11-14	Good access, high standard road to site; good access within site 15-18
(e) Environmental Total Points: 20 Point Value:	Low esthetic factors[4] that significantly lower quality[5] 0-2	Average esthetic quality; factors exist that lower quality to minor degree 3-6	Above average esthetic quality; any limiting factors can be reasonably rectified 7-10	High esthetic quality; no factors exist that lower quality 11-15	Outstanding esthetic quality; no factors exist that lower quality 16-20

[1]Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
[2]Likelihood of success at fishing and hunting.
[3]Value should be adjusted for overuse.
[4]Major esthetic qualities to be considered include geology and topography, water, and vegetation.
[5]Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

SECTION IX - NED BENEFIT EVALUATION PROCEDURE: COMMERCIAL FISHING

6-11**7**. Purpose. This section provides procedural guidance for the evaluation of the national economic development (NED) benefits of water and related land resources plans to commercial fishing. These procedures apply to marine, estuarine, and fresh water commercial fisheries for both fish and shellfish. **[No specific risk-based procedures have been developed for commercial fishing evaluations. In studies where commercial fishing benefits constitute a significant portion of NED effects, FOAs are expected to perform, at a minimum, sensitivity analysis of key variables such as harvest costs, harvest rates an/or ex-vessel prices. FOAs should incorporate the key variables applicable to their specific study area in the risk-based analysis.]**

6-11**8**. Conceptual Basis.

a. The NED benefits are conceptually measured as the change in consumers' and producers' surplus as a result of a plan. However, since proper measurement of these quantities ordinarily requires estimates of supply and demand elasticities, reasonable approximations may be obtained by the following methods:

(1) When no change in aggregate fish catch is expected as a result of a plan (perhaps because of an effective quota system), NED benefits may be measured as cost savings to existing fish harvests.

(2) When the fish catch is projected to change as a result of a plan, but the change is too small to affect market prices, a seasonally-weighted average of recent prices may be used to value the without and with plan harvests. In this case, it may be convenient for computational purposes to break the total change in income into two parts: (a) the cost savings for the existing (without plan) catch; and (b) the change in net income associated with the incremental catch. This latter part may be measured as the change in total revenue due to the increased catch minus the change in total cost due to harvesting the increased catch.

(3) When the additional fish catch is expected to affect market prices, the change in net income may be estimated in two parts: (a) the cost savings for the existing, or without plan, catch; and (b) the change in net income associated with the incremental catch. The incremental gross revenue may be estimated by multiplying the change in catch by a price midway between expected without and with plan prices. The incremental cost of the harvest is then subtracted from the estimated incremental gross revenue.

b. Harvest costs expected to vary between the with and without plan conditions should be analyzed.

(1) These include the cost of equipment ownership and operation; harvesting materials; labor and management; maintenance operation, and replacement. Examples of changed costs include reduced travel time, reduced travel time to safe moorage in storm conditions, reduced costs associated with more efficient or larger boats, reduced time awaiting favorable tides, damage reduction to vessels or facilities, reduced fish spoilage, and reduced maintenance expenditures. If costs associated with plan measures (e.g., dock costs, harbor facilities, etc.) are included in the plan cost analysis, exclude them from harvest costs.

(2) Value purchased input at current market prices. Value all labor, whether operator, hired or family at prevailing labor rates. Value management at 10 percent of variable harvest costs and interest at plan discount rates.

(3) Project current production costs to the selected time periods; any changes should reflect only changes in catch or physical conditions.

6-11**9**. Planning Setting.

a. Without Plan Condition. The without plan condition is the most likely condition expected to exist in the future in the absence of any of the alternative plans being considered. Several specific elements are included in the without plan condition:

(1) Habitat condition. The biological resources consist of stocks of living resources subject to commercial fishing, any living resources ecologically related to the stocks, the migration pattern and reproduction rate of the stocks, and any physical characteristic of the environment essential to these living resources.

(2) The institutional setting. Existing and expected local, State, regional, national, and international policies and regulations governing the harvest and sale of the affected species, including the level of access to the fishery are included in the without plan condition. Other revisions of such policies and rules of the alternative plans being studied.

(3) Nonstructural measures. The effects of implementing reasonably expected nonstructural measures. Nonstructural measures include prevention of pollution to the marine environment or relocation of shore facilities.

(4) Market conditions. Information on the without plan situation includes the projected number of harvesters, the percentage of their time and capacity utilized, harvest technology, the markets in which they buy inputs, fishing efforts, probable harvests, harbors and channels utilized, ex-vessel price of harvests, and probable processing and distribution facilities. See paragraph 6-117. Project market conditions that are consistent with the projected biological and institutional conditions.

b. With Plan Condition. The with plan condition is the most likely condition expected to exist in the future with a given alternative. The elements and assumptions included in the without plan condition are also included in the with plan condition. Special attention should be given to tracing economic conditions related to positive or negative biological impacts of the proposed plan.

6-1**20**. Evaluation Procedure: General. Follow the steps in paragraphs 6-12**1** through 6-12**4** to estimate NED benefits to commercial fishing from water or related land resources plans. The level of effort expended on each step depends on the nature of the proposed project, the reliability of data, and the degree of refinement needed for plan formulation and evaluation. (See Figure 6-9)

6-12**1**. Evaluation Procedure: Identify the Affected Areas.

a. Identify the areas which the proposed alternative plans will have biological impacts.

b. Identify the areas in which the proposed alternative plans will have economic impacts.

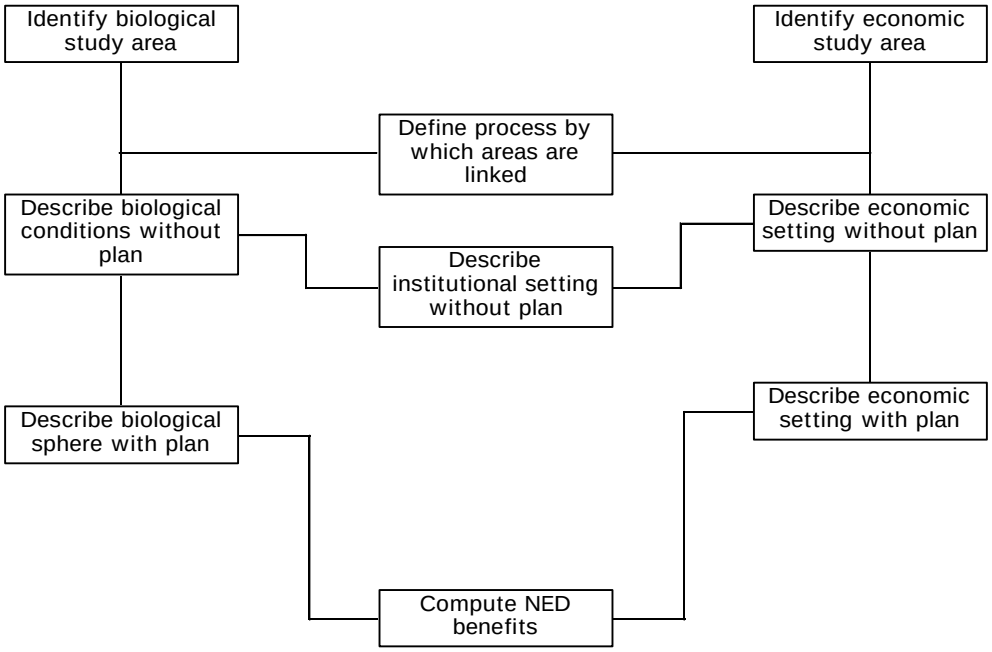


Figure 6-9. Commercial Fishing Benefit Evaluation Procedure

c. Describe the process by which the biological and economic study areas are linked.

6-12**2**. Evaluation Procedure: Determine the Without Project Condition.

a. Estimate the harvest of the relevant species in physical terms if a plan is not undertaken. Include a detailed description of the stock, including catch per unit of effort and whether the estimated harvest is at, or near, the range of absolute decreasing returns. (See paragraphs 6-11**9**a(1) and 6-12**5**a)

b. Describe the most likely set of institutional conditions that would exist without a project. (See paragraph 6-11**9**a(2).)

c. Estimate the total cost of harvesting the relevant species in each of the relevant years if a plan is not undertaken. For each relevant species, determine the current weighted ex-vessel price corrected for seasonal fluctuations. (See paragraph 6-11**9**a(4).)

6-12**3**. Evaluation Procedure: Determine Conditions That Would Exist With an Alternative Plan.

a. Estimate the harvest of the exploited stocks in each of the relevant years if an alternative plan is undertaken.

b. Estimate the seasonally corrected current price of the harvested species and the total cost of harvesting in each of the relevant years if a plan is undertaken. This will require an understanding of the economics of entry and exit for the fish harvesting industry, as well as the effects of a change in harvest rates on the catch per unit of effort.

6-12**4**. Evaluation Procedure: Estimate NED Benefits.

a. Calculate the ex-vessel value of the harvest (output) for each alternative plan and for the without plan condition.

b. Determine the harvesting costs, including nonproject operation, maintenance, and replacement, for the level of catch (output) identified by each alternative plan and the without plan condition.

c. Compute the NED benefit from an alternative plan as the value of the change in harvest less the change in harvesting cost from the without plan condition to the with plan condition.

6-12**5**. Problems in Application.

a. As the harvest rate of living stocks goes up, it is possible to reach a range in which the increases in annual harvesting efforts will actually produce a long-run decrease in the quantities harvested. In the absence of effective limits on harvesting, it is possible that commercial fishing will operate in this range of absolute decreasing returns. This is possible because individual operators will compare only their revenues and costs; they will not be concerned with the absolute productivity of the stock. this can be very important in determining NED benefits because what may appear to be a positive effect (something that encourages an increase in harvesting effort) may ultimately result in negative benefits (decreased total harvest and increased total cost per unit of harvest).

b. The fact that fish are common, as opposed to private, property creates special problems in measuring NED benefits. Unless entry is restricted, excessive quantities of capital and labor may enter a fishery; that is, entry may continue until the "economic rent" from the living stock is dissipated. This excess entry will result in economic inefficiency in the utilization of fishery resources because the value of the resulting extra output will be less than the social opportunity cost of the entry. Some economic benefits may be realized but the total benefits will not be as large as they might be if entry were restricted. Although evaluation of this potential has been limited by the specification of the with and without plan condition in paragraph 6-118, three specific points are worth of separate mention.

(1) Transitory benefits. Because the benefits from harvesting open-access fisheries tend to be dissipated through entry of excess capital and labor, some NED benefits from commercial fishing can be transitory. It will therefore be necessary to determine how many years these benefits will last and in what amounts for each year.

(2) Industry capacity. The excess capacity that will normally exist will make it difficult to obtain a proper estimate of changes in cost associated with changes in harvests. In some instances, idle boats will be available and the only additional costs will be operating costs. In other instances, vessels that are already operating will be able to harvest the extra catch without significant change in variable costs.

(3) Regulation. Because of the tendency of open-access fisheries to attract excess capital and labor which can deplete the stocks, most commercial fishing operations are currently subject to government regulations which stipulate the manner, time, place, etc., in which harvesting may take place. These stipulations usually result in harvesting activity that is not as economically efficient as it might be. These stipulations will therefore affect the size of NED benefits.

6-12**6**. Data Sources.

a. Data for annual harvests, demand, harvesting and processing costs, ex-vessel and other prices, physical production, biological modeling, models or information about management policies and regulations, and survey results are available from several Federal, State, and local government agencies, universities (especially those with sea grant programs), private organizations (such as industry groups, fishermen unions, or cooperatives), regional fisheries management councils, and international commissions or organizations.

b. Initial contacts should be made with the National Marine Fisheries Service Regional Office, United States Coast Guard, State resource agencies having management or other responsibility for the fishery or resource in question, and all local or regional fishery councils, commissions, or institutes that have responsibility or jurisdiction or that are functioning within the area affected by the project. Fisheries dynamics biologists at universities or at National Marine Fisheries Service regional laboratories will be the best source of information on biological effects and their repercussion in the market.

6-12**7**. Report and Display Procedures.

a. Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Table 6-31 is a suggested method of data presentation. Its use will provide the reader with information on physical changes in output as well as value.

b. Because the benefits are broken down into annual flows, it will be possible to determine if and when the open access nature of commercial fishing will lead to a dissipation of any NED benefits provided by the project.

Table 6-31
Commercial Fishing Benefits

Benefit	Years		
	1	2	3
(1) Change in output.....	.....	.....	.....
(2) Value of change in output (line 1 times expected price)	.....	.....	.....
(3) Change in costs	.....	.....	.....
(4) NED benefit (line 2 minus line 3).....	.....	.....	.....

SECTION X - NED BENEFIT EVALUATION PROCEDURES: OTHER DIRECT BENEFITS

6-12**8**. Purpose. This section provides a definition of other direct benefits and procedural guidance for the evaluation of other direct benefits attributable to water resources plans and projects. Other direct benefits are the incidental direct benefits of a project. The other direct benefits to be included in the NED benefit evaluation are the incidental effects of a project that increase economic efficiency by increasing the output of intermediate final consumer goods over and above the direct outputs for which the plan is being formulated.

6-12**9**. Conceptual Basis. Other direct benefits are incidental to the primary purposes of water resource projects. Primary purposes of projects are those purposes for which the alternative plans are formulated. Other direct benefits derive from incidental increases in outputs of goods and services or incidental reductions in production costs.

6-1**30**. Planning Setting. Standard planning procedures involve comparison of the with project condition to the without project condition. In considering other direct benefits, define the boundary of direct influence of the plan. Economic efficiency gains to firms in production and satisfaction gains to consumers other than those identified as the direct beneficiaries of primary project purposes should be valued and measured as other direct benefits.

a. Without Project Condition. Forecast future conditions expected to exist without implementation of the plan. The without project condition is the projection of output and production levels and costs of production likely to be achieved in the absence of a plan.

b. With Project Condition. Future conditions expected to exist when the plan is fully implemented. The with project condition is the projection of output and production levels and the costs of production likely to be achieved with the plan.

6-13**1**. Evaluation Procedure: General.

a. When applicable, compute other direct benefits according to the procedures for measuring benefits in this chapter. Some benefits, such as reduced water supply treatment costs, can be computed on the basis of reduced costs to consumers.

b. Improvement in production possibilities of the private market sector as well as the nonmarket sector recreation are other direct benefits. The following are examples: a large water storage project is to be located upstream on a main tributary of a river system that enters the ocean by a delta through an estuary. The direct output of the project is flood control for communities residing on floodplains along upper valleys of the tributary. One effect of regulating flow--reducing winter high and summer low flows--is to increase the recreational potential of land and water in the lower reaches of the river system. A cooling of water temperatures and increased flow during summer increases fish and wildlife productivity; riparian habitats along lower water courses expand and increase in density; salt water marshland receives less saline water in summer. As a result, there is an increase in dove and pheasant hunting as these wildlife populations increase. Opportunities for sport angling also increase as game fish productivity rises. Shrimp production benefits from the change to less saline water in the marshland, and commercial shrimp harvest increases, resulting in greater output at lower unit total cost to shrimp fishermen. An incidental effect is the improvement in water quality to downstream users; turbidity is reduced in winter and water hardness is reduced in summer. Treatment costs are lower for

firms and households. If the impoundment causes the recharge of groundwater basins in the vicinity of the dam site or along the stream course, these incidental effects are other direct benefits. Pumping costs could be reduced.

6-13**2**. Evaluation Procedure: Problems in Application. The major problems encountered in the estimation of other direct NED benefits are the identification of the firms, industries, and consumers who will be subject to these incidental effects caused by projects and plans. It must be emphasized that it is not practical or economic to trace out all direct effects.

a. Determining the "context" or system within which the major incidental impacts might be experienced is a useful first step in identifying likely direct benefits worth measuring. The immediate watershed or the subsystem of a river system would constitute a relevant context. The delineation of geographical and economic market regions in which impacts are likely to be felt cannot usually encompass the whole regional economy in a highly industrialized area. Nevertheless, it is important to avoid delineating too small an area in which to search for possible effects.

b. Another procedure for identifying likely impacts is tracing the hydrologic changes that will occur as a result of the project. For example, flows downstream and in other parts of a river system can be changed in quantities and qualities; the water's chemical and physical characteristics--oxygenation, turbidity, temperature, etc.--can undergo change that may impact on fish and wildlife resources and on the production functions of firms and the satisfaction of consumers.

6-13**3**. Evaluation Procedure: Data Sources. An assessment of the current situation and the economic efficiency of potentially affected firms and individuals usually entails the collection from primary sources of data on cost, production function, and firm capacity. Studies of industrial structure and the interdependence of firms in the supply of various inputs and the use of outputs can provide valuable supplemental information.

6-13**4**. Evaluation Procedure: Risk and Uncertainty. Other direct benefits are unique to each project design and its location, so the historical record of data is of limited usefulness. The risk and uncertainty attached to the hypothesized outcomes can be reduced by clearly revealing areas of uncertainty. A physical description of other direct benefits, together with assessment of their relative (major or minor) significance, is an integral part of such a procedure. Nevertheless, these estimates may involve high degrees of risk and relative uncertainty, based as they are on the total mix of project outputs and the effect these mixes would have on stimulating increased productivity.

6-13**5**. Report and Display Procedures. Other direct benefits should be identified by component and added onto the benefits of the benefit-cost analysis. The method used to value the benefits should be presented in the report. Provide a tabular breakdown of all other direct benefits claimed for the project.

SECTION XI - NED BENEFIT EVALUATION PROCEDURES: UNEMPLOYED OR UNDEREMPLOYED LABOR RESOURCES

6-13**6**. Purpose. The economic effects of the direct use of otherwise unemployed or underemployed labor resources during project construction or installation may, under certain conditions, be included as a national economic development (NED) benefit. Because of the dynamic nature of unemployment situations, the appropriateness of these benefits will be determined in consideration of economic conditions existing at the time the project is submitted for authorization and for appropriations to begin construction. This section provides procedural guidance in the evaluation of NED benefits resulting from increased employment of these labor resources. Use the procedures described in paragraph 6-13**9** to calculate these benefits for all structural and nonstructural alternatives considered during the planning process.

6-13**7**. Conceptual Basis.

a. The social cost of a project is less than the market contract cost in situations in which otherwise unemployed or underemployed labor resources are used in project construction. The opportunity cost of employing otherwise unemployed workers in project construction or installation is equal to the value of leisure time foregone by such workers. Because society does not give up any alternative production of goods and services and because it would be difficult to measure the value of leisure time foregone, a zero opportunity cost is used in these procedures. The opportunity cost of employing otherwise underemployed workers equals their without project earnings, which, by virtue of their underemployment, are less than their market cost. The most straightforward way to reflect the effects of employing unemployed or underemployed labor resources would be to reduce by the appropriate amount the project construction costs in the NED account, but this method would cause accounting difficulties in appropriations, cost allocation, and cost sharing. Therefore, these effects are treated as a project benefit in the NED account.

b. Conceptually, any employment, anywhere in the Nation, of otherwise unemployed or underemployed resources that results from a project represents a valid NED benefit. However, primarily because of identification and measurement problems and because unemployment is regarded as a temporary phenomenon, only those labor resources employed onsite in the construction or installation of a project or a nonstructural measure should be counted. Benefits from use of otherwise unemployed or underemployed labor resources may be recognized as a project benefit if the area has substantial and persistent unemployment at the time the plan is submitted for authorization and for appropriations to begin construction. Substantial and persistent unemployment exists in an area when:

(1) The current rate of unemployment, as determined by appropriate annual statistics for the most recent 12 consecutive months, is 6 percent or more and has averaged at least 6 percent for the qualifying time periods specified in subparagraph (2) below and:

(2) The annual average rate of unemployment has been at least: (a) 50 percent above the national average for three of the preceding four calendar years, or (b) 75 percent above the national average for two of the preceding three calendar years, or (c) 100 percent above the national average for one of the preceding two calendar years.

c. Only the portion of project construction activity located in such an area is eligible for employment benefits as calculated in accord with the procedures specified below. Any benefit claimed

should be clearly justifiable both in terms of availability of amounts of unemployed and/or underemployed labor and their skills and occupations.

6-13**8**. Planning Setting.

a. Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of a project, including known changes in law or public policy. The evaluation of NED benefits associated with the use of otherwise unemployed and underemployed labor resources is linked to the number by which these resources would be reduced over time without a project.

b. With Project Condition. The with project condition is the most likely condition expected to exist in the future with a given project alternative. There is a different with project condition and thus a different employment benefit for each alternative plan. Currently, the employment benefit cannot be estimated directly on the basis of a comparison of the size of the pools of unemployed and underemployed labor with and without a project. Instead, the benefit procedure implicitly projects the percentage of project labor hires estimated to come from the unemployed labor pool.

6-13**9**. Evaluation Procedure.

a. Step 1. Calculation of employment benefits is limited to onsite project construction or installation activity in eligible regions as defined in paragraph 6-13**7**b. The first step therefore is to determine whether a project is wholly or partially located in an eligible area.

b. Step 2. Estimate the number of skilled and unskilled unemployed construction workers in the labor area. Construction labor pool data are usually available from local offices of State employment security agencies.

c. Step 3. Determine the labor requirements for plan implementation as follows:

(1) Labor cost. The manpower requirements of water resource projects differ widely. Construction cost estimate data will provide the percentage of labor cost to total construction contract cost.

(2) Manpower requirements. Analyze the plan's construction work force and schedule to determine manpower requirements over the construction period for skilled and unskilled categories of workers. Convert these data to total construction wages in skilled and unskilled categories by year of construction. In addition, estimate the yearly wage bill of other workers needed on the project. Use the occupational tables in Table 6-32 in this section to categorize different types of workers.

d. Step 4. Compare the annual manpower requirements of the project to the size of the unemployed labor pool in eligible regions. If labor availability is significantly larger than labor requirements, proceed to the next step. If not, reduce the percentages in the next step based on one or both of the following: expert interviews; or a careful matchup of requirements and availability for specific types of jobs (e.g., carpenters).

e. Step 5. Calculate NED employment benefits.

(1) Standard method. The following percentages are derived from An Evaluation of the Public Works Impact Program (PWIP).[1] Although the projects studied in the PWIP report are not fully comparable to many typical water projects, the report does provide an empirical basis for relating public works expenditures to employment of unemployed workers. Case 1, below, covers situations in which there is no "local hire" rule; it is taken directly from the PWIP report, as PWIP has no local hire rule. Case 2 covers situations in which there is a local hire rule; the reference data are modified to account for an 80-percent local hire by scaling up the actual local hires (for skilled and unskilled workers) to 80 percent, but retaining the distribution of local hires previously employed to local hires previously unemployed.

(a) Case 1, NED benefits, no local hire rule. Multiply the total wages determined by categories of workers (skilled, unskilled, and other) by the following percentages to obtain NED benefits by year of construction:

Skilled--30
Unskilled--47
Other--35

(b) Case 2, NED benefits, local hire rule. Apply the following percentages in Case 2 situations:

Skilled--43
Unskilled--58
Other--35

Because the 80-percent local hire rule is a goal, not a requirement, support these percentages by data that indicate the local hire goal is likely to be met. If this is unlikely, reduce Case 2 percentages to numbers between the standard Case 1 and Case 2 percentages.

(c) Annual NED benefits. Convert the NED benefits by year of construction to an annual equivalent basis using the current discount rate.

(2) Alternative methods. The percentages of unemployment hires may be changed from those used in the standard method if the change can be supported by an empirical study that shows different percentages of unemployed and underemployed workers on a similar project, or on a segment of the same project, for labor market conditions similar to those of the proposed project. In using this method, it may be necessary to vary the categorization of construction workers used in the standard method. The opinions of experts such as local State employment security agencies, local construction firms, associations of contractors, and labor unions may not be substituted for empirical data. Studies used

[1]Economic Development Administration, U.S. Department of Commerce. *An Evaluation of the Public Works Impact Program (PWIP)*. Springfield, VA, National Technical Information Service (PB-263 098), January 1975.

to document alternative percentages for specific types or locations of projects should be cited if not included in the project report.

(3) The percentages are used in the standard method to measure wages paid directly to previously unemployed workers. Previously employed workers may vacate jobs that then become available to unemployed workers, but there are no empirical data to support a quantification of such indirect effects, and no estimates of these effects should be included in the NED account.

6-1**40**. Report and Display Procedures. Include the employment benefits of each alternative plan as a line item in the display of NED benefits in the system of accounts for any project or portion of a project located in an area that contains unemployed or underemployed resources, as defined in paragraph 6-13**7**b.

6-141. Problems in Application.

a. An IWR publication provides techniques for estimating benefits associated with the direct use of otherwise unemployed labor resources during project construction. The Report of Survey of Corps of Engineers Construction Workforce (IWR Research report 81-R05) provides an empirical basis for changing the percentages of unemployed specified in this section. Section I (paragraph 6-2) requires that new evaluation techniques be approved by the Water Resources Council. Therefore, if the approach in the IWR report is used, the techniques specified in this section should also be used to demonstrate the sensitivity of the results to the different methods.

b. Unemployment benefits shall not be used in project formulation, scaling, or NED plan determination. These benefits shall not be used to justify a project where the BCR is otherwise less than unity.

Table 6-32
Occupational Tables
(For use in evaluation of unemployed or underemployed labor)

BLUE COLLAR UNSKILLED OCCUPATIONS

Bricklayer Apprentice
Carpenter Apprentice
- Apprentice Carpenter
- Carpenter Helper

Chainman
Deck Hand
Electrician Apprentice
- Apprentice Electrician
- Apprentice Wireman
- Electrician Trainer

Iron Worker Apprentice
Laborer
- Asphalt Distributor
- Assistant Carpenter
- Bottom Laborer
- Brick Tender
- Carpenter Aid
- Carpenter Helper
- Chainsawman
- Common Laborer
- Concrete Barker
- Concrete Laborer
- Concrete Saw
- Construction Laborer
- Ditch Laborer
- Drill Helper
- Flag Person
- Hod Carrier
- Kettleman
- Laborer
- Laborer Apprentice 3rd
- Laborer Group I
- Laborer Group V
- Labor Shop Man
- Laborer Topman
- Laborer Utilityman
- Landscape Laborer
- Mason Helper
- Mason Laborer
- Mason Tender
- Mortarman
- Mortarmier
- Pipe Layer
- Pipe Helper
- Pipe Fitter
- Plasterer Tender
- Powerman
- Pusher
- Rakeman
- Reboundman
- Road Laborer
- Roof Helper
- Sand Blaster
- Set-up-man
- Sprinkler Apprentice
- Stake Setter
- Tender
- Termite Operator
- Tile Setter Operator
- Vibrator Operator
- Water Truckman

Lumberman and Nurseryman
- Tree Thinner
- Treeman
- Treeplanter

Operating Engineer Apprentice
- B. M. Apprentice
- EO Group III
- EO Group 222

Plumber Apprentice
- Plumber Apprentice
- Plumber Helper

Painter's Helper
Sheet Metal Apprentice
Vibrator Operator
Watchman
- Night Watchman

BLUE COLLAR SKILLED OCCUPATIONS

Blaster
Boilermaker
Boilermaker Foreman
Bricklayer

Table 6-32 (Continued)

Occupational Tables

BLUE COLLAR SKILLED OCCUPATIONS (Continued)

Bricklayer (continued)
- Block Layer
- Truckpointer
- Brick Mechanic

Bricklayer Foreman
Carpenter
- Form Setter
- Journeyman Carpenter
- Soft Floor Layer

Carpenter Foreman
Carpenter Superintendent
Cement Mason
- Finisher
- Journeyman Finisher

Cement Mason Foreman
Diver
Driller
- Drill Rig Operator

Electrician
- Journeyman Electrician
- Mechanical Electrician
- Wireman
- Journeyman Wireman

Electrical Foreman
General Foreman
- General Labor Foreman
- Project Foreman

Glazier
Iron Worker
- Reinforcing Ironworker
- Structural Ironworker
- Steel Worker
- Steel Erector
- Steel Setter
- Reinforcing Steel Worker

Iron Worker Foreman
- Labor Foreman
- Construction Foreman
- Foreman
- Job Foreman
- Lead Foreman

Lather
Lather Foreman
Master Mechanic
Mechanic
- Mechanic Welder
- Repairman

Mechanic (Continued)
- Repairman Leadman

Oiler
Oiler Equipment Operator
- Oiler Operator Group II
- Oiler Track Type

Operating Engineer
- Asphalt Distributor Operator
- Asphalt Heaterman
- Backhoe Operator
- Blade Operator
- Bobcat Operator
- Bulldozer Operator
- Case Operator
- Class A Operator
- Class C Operator
- Crane Operator
- Digger Operator
- Distributing Operator
- Dragline Operator
- Equipment Operator
- Equipment Operator Group III
- Front End Lift Fork Operator
- Heavy Equipment Operator
- Hi-Lift Operator
- Lift Fork Operator
- Loader Operator
- Maintenance Loadman
- Motor Grader Operator
- Operator Group III
- Pan Operator
- Park Equipment Operator
- Power Drive Moister Operator
- Power Equipment Operator

Operating Engineer Foreman
- Leader Operator

Painter
- Brush Painter

Table 6-32 (Continued)
Occupational Tables

BLUE COLLAR SKILLED OCCUPATIONS (Continued)

Painter (continued)
- Roller Painter
- Spray Painter

Painter Foreman
Pile Driver
Pipe Fitter
- Sp. Box Man

Pipe Fitter Foreman
- Sprinkler Foreman

Plasterer
Plasterer Foreman
Plumber
- Pipe Layer

Plumber Foreman
- Plumber General Foreman
- Plumber Superintendent

Rigger Foreman
Roofer Sheet Metal Worker
- Journeyman Sheet Metal
- Sheet Metal Mechanic
- Sheet Metal Operator

Sheet Metal Foreman
Steam Fitter
Tile Setter
Truck Driver
- Worker
- Axle Truck Driver
- 4 Axle Truck Driver
- Dump Truck Driver
- Road Truck Driver
- Tandem Truck Driver
- Truck Driver II
- Truck Driver Highway

Waterproof Foreman

SECTION XII - NED COST EVALUATION PROCEDURES

6-14**2**. Purpose. This section provides procedures for the evaluation of NED costs of structural and nonstructural elements of water resource plans and projects.

6-14**3**. Conceptual Basis.

a. Project measures, whether structural or nonstructural, require the use of various resources. NED costs are the opportunity costs of resource use. In evaluating NED costs, resource use must be broadly defined so as to fully recognize scarcity as a component of value. This requires consideration of the private and public uses that producers and consumers are currently making of available resources or are expected to make of them in the future.

b. The opportunity costs of resource use are usually reflected in the marketplace. When market prices adequately reflect total resource values, they are used to determine NED costs. When market prices do not reflect total resource values, surrogate values are used appropriately to adjust or replace market prices.

c. Total NED cost is the market value of a resource plus other values not reflected in the market price of the resource; it therefore accounts for all private sector and public sector uses. Market price is used to reflect the private sector use of resources required for or displaced by a project, and surrogate value is used to reflect the public sector use.

(1) The market price approach relies on the interaction of supply and demand. Price is determined through transactions on the margin between knowledgeable and willing buyers and sellers, neither of whom are able to influence price by their individual decisions. Distortions in market price occur if one or more of the conditions of perfect competition is violated.

(2) The surrogate value approach involves the approximation of opportunity costs based on an equivalent use or condition. Surrogate values are frequently used in restricted markets and in nonmarket situations.

d. Proper NED analysis requires that project NED costs and benefits be compared at a common point in time. Costs are calculated in annualized terms (see paragraph 6-4).

6-14**4**. Planning Setting. The basis for the evaluation rests in a thorough analysis of expected conditions in the future with a project and without a project. This requires identification of those resources that will be affected by a project; the current value of such uses is measured as the economic worth to the Nation of the services associated with those uses.

6-14**5**. Evaluation Procedure: General.

a. Resources required or displaced to achieve project purposes by project installation and/or operation, maintenance, and replacement activities represent a NED cost and should be evaluated as such. Resources required or displaced to minimize adverse impacts and/or mitigate fish and wildlife habitat losses are also NED costs. Costs for features not required for project purposes, avoiding adverse effects, and/or mitigating fish and wildlife habitat losses are not project-related NED costs and

should not be evaluated. **[Costs for features not required for project purposes will generally not be part of the Corps project.]**

b. Base all NED costs on current costs adjusted by the project discount rate to the beginning of the period of analysis as defined in paragraph 6-3c. Compute all costs at a constant price level and at the same price level as used for the computation of benefits. Base current costs on the price level at the time of the analysis. These costs will be updated in the year(s) the project is submitted for authorization and/or appropriations. Discount deferred costs to the end of the installation period, using the applicable project discount rate. Increase costs incurred before the beginning of the period of analysis by adding compound interest at the applicable project discount rate from the date the costs are incurred to the beginning of the period of analysis. Convert all NED costs to an annual equivalent value over the period of analysis.

c. Project NED costs may be adjusted by an allowance for the salvage value of land, equipment, and facilities that would have value for nonproject uses at the end of the period of analysis. Significant salvage values of replaceable items (e.g., generators) will normally become adjustments to allowances for replacement costs.

d. Estimates of real price changes in the valuation of benefits and costs associated with Corps of Engineers civil works projects will not be incorporated into benefit-cost studies without prior permission from HQUSACE. Should a District believe that special and unique circumstances in a study area require the estimation of real price changes to accurately conduct plan formulation, the issue must be surfaced to CECW-P prior to expenditure of resources. As needed, CECW-PD will assist in development of appropriate metholds for evaluating these changes.

6-14**6**. Evaluation Procedure: Implementation Outlays. The NED costs of implementation outlays include the costs incurred by the responsible Federal entity and, where appropriate, contributed by other Federal or non-Federal entities to construct, operate and maintain a project in accordance with sound engineering and environmental principles and place it in operation. These costs are the remaining postauthorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archaeological salvage costs; land, water, and mineral rights costs; and operation, maintenance, and replacement costs.

a. Postauthorization Planning and Design Costs. The costs are the direct cost for investigations, field surveys, planning, design, and preparation of specifications and construction drawings for structural and nonstructural project measures. In the evaluation procedure, base these costs on the actual current costs incurred by the responsible Federal entity for carrying out these activities for similar projects and project measures. They may be computed as a percentage of construction costs when there is a documented basis for the rate used. Make adjustments when appropriate to reflect circumstances special to the project under consideration.

b. Construction Costs. These costs are the direct cost of installing project measures. They should be based on the market value of goods and services required to install project measures, including those measures required for avoiding adverse environmental effects and public health and safety risks. They include the cost of purchased materials (including associated transportation costs); equipment rental or purchase; construction wages or salaries (including social security and fringe benefit costs); and contractors' management, supervision, overhead, and profit. Base such costs on current

contract bid items in the project area or on the current market value of purchased materials and services, etc.

c. Construction Contingency Costs. These are project costs normally added to reflect the effects of unforeseen conditions on estimates of construction costs. They are not an allowance for inflation or for omissions of work items that are known to be required. They are included to cover unforeseen construction problems. These costs will vary with the intensity of the surveys and investigations performed, the variability of site conditions, and the type of project measures being installed. They may be computed as an appropriate percentage of estimated construction costs. **[If contingency costs are included in real estate costs, planners shall ascertain the basis for these contingent costs. To the extent that contingencies are meant to account for inflation, this effect shall be excluded from real estate costs for evaluation purposes. Only that portion of real estate contingency cost for which there is reasonable basis for anticipating uncertainty (condemnation costs may be an example) shall be included.]**

d. Administrative Services Costs. These are the costs associated with the installation of project measures, including the cost of contract administration; permits needed to install the project measures; relocation assistance advisory services; administrative functions connected with relocation payments; review of engineering plans prepared by others; government representatives; and necessary inspection service during construction to ensure that project measures are installed in accordance with the plans and specifications. Base these costs on the actual current costs incurred by the responsible Federal entity for carrying out these activities for similar projects and project measures. These costs may be computed as a percentage of construction costs if there is a documented basis for the rate used. Make adjustments when appropriate to reflect unusual circumstances special to the project under consideration.

e. Fish and Wildlife Habitat Mitigation Costs. These are the costs of mitigating losses of fish and wildlife habitat caused by project construction, operation, maintenance, and replacement. The mitigation measures to be included in the project will be determined by the responsible Federal entity in coordination with Federal and State Fish and Wildlife Agencies as required by the Fish and Wildlife Coordination Act (Public Law 85-625). Installation of these mitigation measures should be concurrent with the installation of other project measures, where practical. These costs include all project outlays associated with the installation of mitigation measures, including postauthorization planning and design costs; construction costs; construction contingency costs; administrative services costs; relocation costs; land, water, and mineral rights costs; and operation, maintenance, and replacement costs. Base the costs on current market values and the actual current costs incurred by the Federal entity for carrying out these activities for similar mitigation measures.

f. Relocation Costs.

(1) These are project costs associated with:

(a) The requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646); and

(b) The relocation of highways, railroads, and utility lines.

(2) Real property acquisition relocation payments are applicable to a displaced person, business, or farm operation. The costs include moving and related expenses for a displaced person, business, or

farm operation; financial assistance for replacement housing for a displaced person who qualifies and whose dwelling is acquired because of the project; and termination payments for dislocated businesses whose owners choose to close out. Base the NED cost of replacement housing on replacement in kind. (Costs over and above replacement in kind are treated as financial costs for nonproject purposes.) Base these costs on current market values.

(3) Base the relocation cost of railroads and utility lines on the costs of replacement in kind. In the case of highways, base the relocation cost on replacement that reflects the current traffic count and current standards of the owner, which may result in a justified improvement over the configuration of the existing roadway. The additional relocation cost of highways that are upgraded to increase their carrying capacity for project purposes such as recreation is also a project cost. The relocation cost of highways, railroads, and utility lines shall include all project outlays associated with their relocation, including planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; land, water, and mineral rights costs; and historical and archaeological salvage costs. Base these costs on current market values and the actual current costs incurred by the Federal entity for carrying out similar relocations.

g. Historical and Archaeological Salvage Operation Costs. These are project costs associated with salvaging artifacts that have historical or archaeological values as prescribed by the Preservation of Historic and Archaeological Data Act (Public Law 93-291). Base these costs on the current market price of salvage operations carried on during construction.

h. Land, Water, and Mineral Rights Costs.

(1) These costs include all costs of acquiring the land, water, and mineral rights required for installing, operating, maintaining, and replacing project measures. They include all expenditures incurred in acquiring land, water, and mineral rights, easements, leases, and rights-of-way. Such costs include the cost of the land, water, and mineral rights minus salvage value; the cost of surveys incident to a sale; legal fees and transfer costs; foregone real estate taxes; and severance payments. Base these costs on current market values and the actual current costs incurred by the Federal entity for carrying out similar land, water, and mineral rights acquisitions. Base the market value of easements on the difference in market value of land without the easement and with the easement.

[Foregone real estate taxes shall not be considered an NED cost. The WRC's Guidelines are incorrect.]

(2) Some land, water, and mineral rights are owned by Federal, State, and local governments and have been committed to specific uses. Base the NED cost of using such resources for project purposes consistent with their committed uses on the surrogate value of the public services provided by the resources. For example, if State-owned land committed to recreation use is to be used for project recreation development, its NED cost is not the market value of the land, but he value of the recreation services that would be provided by the land without the project. Public domain lands not committed to specific uses should be valued at the market value of comparable private land or a surrogate use value, or a combination if there are complementary uses.

I. Operation, Maintenance, **Repair, Rehabilitation** and Replacement Costs. These costs represent the current value of materials, equipment, services, and facilities needed to operate the project and make repairs and replacements necessary to maintain project measures in sound operating condition

during the period of analysis. They include salaries of operating personnel; the cost of repairs, replacements, or additions; and an appropriate charge for inspection, engineering, supervision, custodial services, and general overhead. When operation, maintenance, or replacement will be performed by contract, the cost should include an allowance for contingencies and the costs of survey, planning design, and administrative services. Base these costs on actual current costs incurred for carrying out these activities for similar projects and project measures. When the project is an addition to or extension of an existing project for which the costs and benefits are not included or otherwise involved in the project analysis, include only the additional cost of operation, maintenance, or replacement necessitated by the addition or extension to the existing project. Adjustments can be made when appropriate to reflect circumstances special to the project under consideration.

[j. Interest During Construction. This represents the opportunity cost of capital incurred during the construction period. The cost of a project to be amortized is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial cost plus interest during construction. Cost incurred during the construction period should be increased by adding compound interest at the applicable project discount rate from the date the expenditures are incurred to the beginning of the period of analysis. This is comparable to the treatment of benefits that accrue during the construction period (see paragraph 6-156) and is performed to insure costs and benefits are evaluated on a equivalent time basis.

(1) All PED costs are included in project NED costs and are charged interest during construction. This includes any studies performed using PED funds (i.e., physical modeling, plans and specs, etc.) When performing economic updates expended PED costs will be considered sunk and not included in the benefit-cost ratio.

(2) Lands acquired are charged interest during construction from the date they are put to use for project purposes, or the date their non project use ceases, whichever is earlier. Through lease back or other arrangements these dates may differ from date of acquisition.]

6-14**7**. Evaluation Procedure: Associated Costs. Associated costs are the costs of measures needed over and above project measures to achieve the benefits claimed during the period of analysis. For example, associated costs include the cost of irrigation water supply laterals, if they are not accounted for in the benefit estimate. Base associated costs on the current market prices of goods and services required for the installation of measures needed over and above project measures.

[a. Associated costs have often been handled through the self-liquidating cost concept. A self-liquidating cost is the cost of a particular type of asset, that can be operated in such a way that it repays the money spent to acquire it (e.g. mooring or dock space. The use of self-liquidating costs is limited to those cases in which appropriate associated costs are netted out of benefit measures.

b. NED costs include all costs necessary to achieve the claimed benefits. In addition to costs directly related to the Federal project there may be associated costs. These are costs of measures, over and above Federal project measures, which are required for the benefits to be realized. It is preferred that associated costs be explicitly treated as NED project related costs, and appear as costs in benefit-cost ratios. Where the concept of self-liquidating costs has been used to account for associated costs this procedure may continue to be used as long as:

(1) The appropriate associated costs are subtracted from the estimated benefits, and

(2) The associated costs are identified and the netting process documented in project reports.
]

6-14**8**. Evaluation Procedure: Other Direct Costs.

a. These are the costs of resources directly required for a project or plan, but for which no implementation outlays are made. Consequently, they are included in the economic costs of a plan but not in the financial costs. These costs may be important for both structural and nonstructural plans. For example, a zoning plan to preserve floodplain values by restricting development would have as a cost the value of with project development opportunities foregone. A plan that responds to demand growth by reallocating existing outputs from low value uses to high value uses through pricing mechanisms (i.e., raising the price of existing outputs) would have as its major cost the value of the outputs to the users who forego its use as a result of its higher price. On the other hand, a structural project may displace recreation use at the project site. Whenever possible, compute these costs using the procedure set forth in this manual for computing benefits. If these costs are not quantified, they should be otherwise identified.

b. Other direct costs also include uncompensated NED losses caused by the installation, operation, maintenance, or replacement of project or plan measures. All uncompensated net losses in economic outputs (not transfers) that can be quantified shall be considered project NED costs. The evaluation of such costs requires an analysis of project effects both within and outside the project area.

c. Examples of other direct costs include increased downstream flood damages caused by channel modifications, dikes, or the drainage of wetlands; increased water supply treatment costs caused by irrigation return flows; erosion of land along streambanks caused by dams that prevent the replenishment of bedload material; loss of land and water recreation values through channel modifications, reduced instream flow due to consumptive use of water by irrigated agriculture, or inundation by reservoirs; increased transportation costs caused by rerouting traffic around a reservoir; new or increased vector control costs caused by the creation of wetlands; and decreased output or increased cost per unit of output of private firms caused by project-induced decreases in raw materials. When applicable, compute such costs using the procedures for computing benefits contained in this chapter. Some costs, such as increased water supply treatment costs, may be computed on the basis of increased costs to resource users.

6-14**9**. Evaluation Procedure: Problems in Application.

a. Application of the procedures in this section requires care to ensure that all costs are included. The identification and determination of all associated costs and external diseconomies require full perception of the measures required to achieve the benefits being claimed and the impacts produced by the actions taken. It must be emphasized that it is not practical or economic to trace out all other direct effects.

b. Application of the procedures in this section requires care to avoid double counting. A full understanding of the values reflected by market and surrogate values is necessary to prevent double counting. For example, the market value of land that includes a private recreation development reflects the recreation value. In this case, double counting would result if a surrogate recreation value (loss)

were added as a cost. On the other hand, the market value of land that provides free public recreation does not reflect the recreation value, so the surrogate recreation value (loss) must be added as a cost.

c. Market prices are relatively easy to obtain. However, some prices are subject to large fluctuations in short periods of time, so care must be taken to determine reasonable current costs of such items for project evaluation purposes.

d. Analysts should be aware of the distinction between financial costs and economic costs. Financial costs are any money outlays or accounting transactions or entries whether or not they are payments for resources. NED or economic costs are the opportunity cost of resource use. Financial costs may not be equal to economic costs, sometimes they may exceed or be less than economic costs. Economists need to be aware of this distinction and carefully evaluate the need to adjust financial costs for economic evaluation.

(1) An area of particular concern is real property values (lands, easements, rights of way and properties). From an economic standpoint, real property values reflect the good's relative scarcity and are typically determined by the interaction of supply and demand. This does not necessarily differ from the concept of value as estimated by realtors and appraissers but in the latter case the resulting value is greatly influenced by legal and institutional constraints. Economists evaluate the social value of a project (the cost to society) while appraisers estimate the cost of implementing a project. NED real property costs used in the economic evaluation of a project should reflect the most likely future without project use.

(2) The netting process used by real estate specialists to estimate the value of lands should be fully understood by planners and economists. In some cases, benefits could accrue to particular parcel of lands that could be lost in the netting process. Economists need to fully understand the valuation process to account for all costs and benefits in the economic evaluation.

(3) In the case of donated lands, the financial costs could be equal, higher or lower than the economic costs depending on the relationship between the appraissed value and the actual credit provided to the non-Federal sponsor and other factors. Economists need to be fully aware of the assumptions and procedure used to estimate the value and credit for donated lands. Factors influencing these estimates can vary significantly from project to project. CECW-PD should be contacted for guidance in those instances where the distinction, if any, between economic and financial costs for donated lands is not clear.

(4) No economic costs will be accounted for in the benefit cost analysis for streambeds and channels where there is no change in use with the project. Financial costs might be incurred.

(5) Early and constant communication between economists and real estate specialists is required to identify data needs and uses and adjustments required to estimate economic costs for each particular project.

6-1**50**. Evaluation Procedure: Data Sources. Market price information is available from data on comparable sales, Government publications (e.g., bulletins of the U.S. Departments of Commerce, Agriculture, and Labor), and business reports. Data sources for those NED benefit evaluation procedures having application to cost analysis are covered in their respective sections of this chapter.

6-1**51**. Report and Display Procedures. Display NED costs identified through the procedures described above as line item entries in the adverse effects section of the NED account. The following display tables are suggested:

Table 6-33
Project Investment

	Alternative 1			Alternative 2			Alternative X		
	Unit		Amount	Unit		Amount	Unit		Amount
	Quantity	Price		Quantity	Price		Quantity	Price	
1. Construction cost									
2. Construction contingency costs									
3. Postauthorization planning and design costs									
4. Administrative servcies costs									
5. Fish and wildlife habitat mitigation costs									
6. Historical and archeological salvage operation costs									
7. Land, water, and mineral rights costs									
8. Relocation costs									
9. Interest during installation period at a rate of ___%									
Total investments									
Price level: _____									
Installation period: _____									
Period of analysis: _____									

Table 6-34
Annualized Adverse Effects

	Alternatives		
	1	2	X
Interest on investment			
Amortization on investment			
Average operation and maintenance			
Major replacement			
Associated costs[a]			
Other direct costs[a]			
Total annualized costs			
Other adverse effects not evaluated in monetary terms[a]			

SECTION XIII - OTHER ECONOMIC EVALUATION PROCEDURES

6-15**2**. Purpose. This section provides evaluation and planning guidance not specifically contained in Sections I through XII. It comprises topics that elaborate, amplify or extend those procedures. Also, additional guidance in general evaluation procedures is presented. In a few instances the guidance is mainly or only for particular project purpose(s) or type(s) of authorization.

6-15**3**. Net Benefits Curve and Documentation of NED Plan Determination. Documentation of NED Plan determination is required by Sections I through XII. See Chapter 5, Section II for details on documentation requirements.

6-15**4**. Non-Standard Procedures. Procedures to calculate the benefit-cost ratio of a project which have not been approved by the Water Resources Council are considered non-standard procedures.

a. Specific approved procedures are in Sections I through XII of this Chapter. The general characteristics of approved procedures are in Chapter 5, Section I.

b. An alternative procedure which is not specifically contained in the NED Procedures may be employed if the following are met:

(1) The procedure is in accord with paragraph 5-8b of Chapter 5, Section I, and estimates of the magnitudes of project effects, that is quantities, are empirically estimated.

(2) The procedure would give a more accurate benefit estimate**; or, it can be demonstrated that the procedure reduces study time and cost and does not alter the formulation of the project**.

(3) The procedure is fully documented.

(4) Prior approval for each application of such alternative procedures is obtained from HQUSACE (CECW-PD). Approval is less likely for procedures proposing use of the cost of an alternative or administratively established values as an estimate of benefits.

c. All other procedures are non-standard and shall not be used in calculating benefit-cost ratios of projects.

6-15**5**. **Current Estimates of Project Benefits. It is Corps policy to report and maintain current estimates of project benefits, costs, and economic justification of all active funded projects and separable elements beginning with the Report of the Chief of Engineers. The purpose of the policy is to provide reasonable estimates of economic justification to sponsors, Congress and Federal decision makers throughout the project development process. An analysis is considered current if it was approved within 3 fiscal years of the pertinent decision date. As an example, in June 1996 budget submissions, the approval date of the document containing the most recent economic analysis could be no earlier than October 1992, since FY 1993 is three fiscal years prior to FY 1996 and October 1992 is the first month of FY 1993. If more than fiscal three years have elapsed since the release of the Report of the Chief of Engineers, an economic reevaluation must be the first item of work upon receipt of funds.**

a. Dates and general guidance for decision requests. The pertinent dates for budgetary and investment decisions, along with guidance for various decision requests are specified below.

(1) New Start PED Budgeting. For all New Start PED funding requests the pertinent decision date is the submission of the budget request to HQUSACE. Benefit-to-cost ratios (BCR), which are required in support of budget requests, will be developed based on the latest approved economic analysis, annualized at the specified discount rates. The current project costs should be deflated to the same price level as in the latest approved economic analysis, annualized at the current interest rate. The report and approval date of that analysis must be cited and should not be more than three fiscal years old. If more than fiscal three years have elapsed since the release of the Report of the Chief of Engineers, an economic reevaluation must be the first item of work upon receipt of funds. Follow-on funding will be contingent upon CECW-AR approval of the economic reevaluation.

(2) Continuing PED Budget requests. For all continuing PED funding requests the pertinent decision date is the division submittal of the budget request to HQUSACE. The same methodology deflating costs to the date of the approved economic analysis and adjusting costs and benefits for the budget year discount rate which applies to New Start PED budget requests should be used for continuing PED funding requests. The three year requirement for updates is also applicable.

(3) New Construction Start Budgeting. For all New Start Construction funding requests for projects and separable elements, the pertinent decision date is the submission of the Division budget request to HQUSACE. The same BCR computation and reporting requirements and the three year updating requirements as applies to NEW Start PED budgeting are applicable to New Construction Start Budgeting. If the reevaluation uncovers major changes that could affect project formulation or sizing, additional PED funds rather than construction funds should be requested to undertake a complete General Reevaluation (GRR) level evaluation.

(4) Project Cooperation Agreements. For all PCA's, the pertinent decision date is the submission of the final PCA to ASA (CW) for approval. If more than fiscal three years have elapsed since the approval date of the latest economic analysis, a reevaluation must be performed in sufficient detail with supporting documentation to show the project remains justified. The reevaluation may be presented in a Limited Reevaluation Report (LRR) which supplements the project document cited in the PCA. Submission of the LRR to HQUSACE for approval must be accomplished prior to submission of the draft PCA.

(5) Non-PCA Projects. The pertinent decision date for approval to initiate expenditures of Construction General appropriations for projects which do not require a PCA, such as inland navigation, is the submission date of the request to HQUSACE. The three fiscal year and reevaluation requirements for PCA's are also applicable to non-PCA projects.

b. Definition of Last Approved Official Document. The approved official document for the Feasibility Report is the Report of the Chief of Engineers. Other approved official documents may include General (GRR) or Limited Reevaluation Reports (LRR), General Design Memorandum (GDM), Design Memorandum (DM), or Post Authorization Change Reports (PACR). If other documents are to be used as the basis for obtaining budgetary or implementation approval, they must be approved by CECW-AR.

c. Plan for Economic Updates. Feasibility reports, General Design Memorandum, General Reevaluation reports and other project decision documents (formulation) documents, shall include a plan for updating project benefits for future reporting and decision making. The economic update plan shall likewise be included in all Project Management Plans. The actions in the plan may be limited in that no major new analyses need be conducted but rather previous assumptions reviewed and updated with techniques such as surveys and sampling employed to develop a reasonable estimate of current project benefits provided no significant changes in without and/or with project conditions have occurred. However, in no event will simple indexing of overall benefits be acceptable. The plan shall include discussions of the data that will be required and the procedures that will be employed. Any rational set of procedures that result in a current analysis of benefits may be acceptable except procedures which amount solely to indexing of benefits. Examples of procedures that could be formulated during feasibility and other studies, and which could be useful in providing current analysis in the future are sampling and monitoring, partial benefit reanalysis, and limited indexing.

(1) Sampling or Monitoring. The focus of the effort should be on factors which are critical to project formulation and feasibility and are representative of the major benefit categories (i.e., inundation reduction benefits in a flood control project or transportation cost savings in a navigation project). For example, in a fully developed floodplain a sample of structures may be selected for development of replacement cost less depreciation of structure values using construction cost models. The values derived could then be used to represent values for the floodplain. For a navigation project, if feasibility depends critically on ships of given characteristics, a plan may be developed to monitor future use of these ships.

(2) Partial Benefit Reanalysis. This study will not have nearly the depth or breadth of a feasibility study. It could be informative regarding current benefits and may be accomplished at reasonable cost. For example, damage calculations at current prices for sampled structures provide valuable information on the current estimate of inundation reduction benefits.

(3) Limited Indexing. Use of generalized indices such as CWCCIS may be used for specific infrastructure benefit categories such as roads, bridges, and rail lines provided these benefit categories do not constitute a major portion of overall project benefits. Additionally, the reevaluation report must document that the infrastructure improvements are still present and used and are subject to comparable flood damages as in the latest report.

d. Content of Limited Economic Reevaluation. Limited Reevaluation Reports (LRR) may be used to document the current economic evaluation of a project or separable elements. However, as discussed in reference 2d, LRRs may be used to report other project changes. Additionally, other reporting documents such as GDMs, DMs, and PACs which do not deal with project formulation issues may also be used to document current economic feasibility.

(1) Scope and Documentation. The limited economic evaluation information submitted to HQUSACE for approval in a reevaluation document needs to be either complete within the document or accompanied by the document it is updating. Limited economic reevaluations must include sufficient data to describe what was done in the previously approved document, what was done in the limited reevaluation, what differences there are and the reasons for the differences. Documentation should cover items which are not strictly socio/economic conditions such as changes in hydrology and hydraulic characteristics or periods of record and costs. This documentation should cover each benefit and cost item, and show net benefits and the benefit cost ratio at the current discount rate.

(2) Format and Displays. A good format would start with brief summary description of the previous approved evaluation and the current reevaluation, accompanied by a tabular display of the changes, followed by support documentation explaining the changes. The following simple display format is a suggested guideline for the tabulation of current costs and benefits and economic justification in a structural flood control project.

	Latest Approved[1]	Current Estimate	Difference	Reason for Difference
Benefit Category[2]				
Inundation				
Residential Structures				
Residential Contents				
Other				
Cost Category				
Construction				
Lands				
Other				
Net Benefits				
Benefit / Cost Ratio				

[1] Cite document, name, date, approval date, price level and interest rate.

[2] Use categories and sub-categories of benefits in latest approved document.

e. Project Changes Requiring More Detailed Analysis. In some instances a more thorough reanalysis than specified in the economic update plan needs to be provided. Examples may include

instances where the previously approved project document predates cost-shared feasibility study planning; an economic benefits update plan has not been approved; the project has not had seamless funding; substancial changes in the without condition, project formulation, project design and/or project costs have occurred. The level of effort for the economic reevaluation should be based on whether the changed conditions warrant a reformulation of a project or a reaffirmation of the justification of the authorized plan. If reformulation, including evaluation of alternative sizes of a project, is warranted a GRR should be prepared and the economic reanalysis should be of similar scope as required for a feasibility study. If reformulation is not warranted a limited economic reevaluation may be documented in an LRR, GDM, or DM. In either case, the economic reevaluation should be complete within the document.

f. Summary. The policy of reporting and maintaining current estimates of project benefits and economic justification can most effectively be accomplished through quality cost estimates in feasibility reports, seamless funding, and development of economic update plans. Through such quality development in the early stages of planning and engineering, the necessity for laborious reevaluation and review can be diminished. Occasionally, more full reanalysis and review are warranted when conditions change and older projects are reintroduced into the system. Though LRR's have often been the principal document to report and obtain approval of current estimates of project benefits and economic justification, they are not the only mechanism. Current economic information must be addressed in a GRR, GDM, DM or any other scheduled document when it is more effective to produce one document instead of two.

6-15**6**. Benefits that Accrue During Project Construction.

a. Benefits accruing during project construction should be documented and included in the benefit evaluation. These benefits should be brought forward from the time the benefits begin to the beginning of the period of analysis, using the project discount rate. All benefits and costs are stated in present worth terms as of the beginning of the period of analysis.

b. Benefits and costs should be identified explicitly. It is not acceptable to simply assume that benefits accruing during project construction are offset by interest during construction. This must be documented (see paragraphs 6-4 **and** 6-14**5**).

6-15**7**. Most Likely Non-Federal Alternative. The cost of the most likely alternative may be used to estimate NED benefits for a particular output if non-Federal entities are likely to provide a similar output in the absence of any of the alternative plans under consideration and if NED benefits cannot be estimated from market price or change in net income. This assumes that society would in fact undertake the alternative means. Estimates of benefits should be based on the cost of the most likely alternative only if there is evidence that the alternative would be implemented. The most likely alternative should in general be something other than a single-purpose project constructed at the same site by the non-Federal entity. In determining the most likely alternative, the planner should give adequate consideration to nonstructural and demand management measures as well as structural measures.

6-15**8**. OMB-approved Survey Questionnaire. This paragraph provides guidance on the use of OMB-approved survey questionnaires for collection of economic data.

a. The requirement for OMB approval of survey questionnaires is noted at several locations in this Chapter and in Chapter 5. Section III.

b. OMB has approved a group of questionnaire items for the collection of planning data. The questionnaire items cover the range of data that would generally be collected by survey in water resources studies.

c. The approved questionnaire items are transmitted by memorandum every three years, as additions and revisions are made and OMB approval is renewed.

d. OMB has given general approval of a comprehensive group of questionnaire items. **The district commander or his designee must thoroughly review the individual questionnaire for quality control purposes before it is used by the district.**

e. **Quality control review should be based upon the need for the questionnaire and the reasonableness and adequacy of:**

(1) The research questions to be answered.

(2) The sampling strategy being employed.

(3) Data collection procedures being employed, and follow up procedures.

(4) Data analysis plan.

f. Additional guidance for the conduct of questionnaire surveys is contained in the memorandum transmitting the approved questionnaire items.

6-15**9**. Opportunity Cost of Time. This paragraph provides guidance for evaluating the opportunity cost of time, when time is saved or lost as a result of implementation of a project. **For a more thorough discussion of this issue, see "Value of Time Saved for use in Corps Planning Studies, A Review of the Literature and Recommendations, IWR Report 91-R-12, October 1991.**

a. Determine the amount of time savings or loss that results from implementation of a project for each economic activity.

(1) The amount of and circumstances resulting in the time savings or loss should be clearly expressed in the "with" and "without" project planning context.

(2) Savings and losses should be estimated by individual or unit economic activity. The number of individuals or economic activities should also be specified.

b. Determine the alternative use of the time savings or losses. **The alternate use will be valued as either work, social/recreation or other.**

c. The following table will be used for the determination of value of time saved in Corps planning studies. Thus, the value of time saved will be different depending on the purpose of the trip and the amount of time saved on each trip. The percentages shown in column (3) can be applied after

the before-tax family income of drivers in the study area is estimated. The dollar values shown in column (2) are based on $49,687, the median family income for the U.S. in 1995 (U.S. Bureau of the Census). The value of time savings for work trips is on a per vehicle-occupant basis. Therefore, to calculate the total value of work time saved per vehicle requires multiplication by the adults per vehicle. For social/recreation, vacation, and other trips, the value of time saved is on a per vehicle basis. The value of time saved for these trip purposes should not be adjusted for the number of passengers.

VALUE OF TIME SAVED BY TRIP LENGTH AND PURPOSE		
	VALUE OF TIME SAVED ADJUSTED TO HOURLY BASIS **$/HOUR**	VALUE OF TIME SAVED ADJUSTED TO HOURLY BASIS % OF HOURLY FAMILY INCOME OF DRIVER
LOW TIME SAVINGS (O-5 MINUTES)		
WORK TRIPS	$1.53	6.4%
SOCIAL / RECREATION TRIPS	0.31	1.3%
OTHER TRIPS	0.02	0.1%
MEDIUM TIME SAVINGS (5-15 MINUTES)		
WORK TRIPS	7.70	32.2%
SOCIAL / RECREATION TRIPS	5.53	23.1%
OTHER TRIPS	3.46	14.5%
HIGH TIME SAVINGS (OVER 15 MINUTES)		
WORK TRIPS	12.86	53.8%
SOCIAL / RECREATION TRIPS	14.34	60.0%

VALUE OF TIME SAVED BY TRIP LENGTH AND PURPOSE		
	VALUE OF TIME SAVED ADJUSTED TO HOURLY BASIS **$/HOUR**	VALUE OF TIME SAVED ADJUSTED TO HOURLY BASIS % OF HOURLY FAMILY INCOME OF DRIVER
OTHER TRIPS	15.40	64.5%
VACATION		
ALL TIME SAVINGS	17.95	75.1%

Note: Work trip is on per person basis while all other trip purposes are on a per vehicle basis.

6-1**60**. Evaluation Procedure for Section 14 Projects.

a. The formulation and analysis of Section 14 projects must do three things: they shall establish that an emergency exists; they shall establish that the facilities to be protected provide economic benefits in excess of the project costs; and they shall establish an array of cost efficient alternatives to address the emergency situation. Evaluation shall determine the economic feasibility of providing protection. Benefits of protection will ordinarily and preferably be the damages prevented by the proposed action, not the increased costs of rebuilding a lost or failed resource. Where possible, conventional with and without project economic analysis maximizing net NED benefits shall be undertaken. An NED plan, or if NED scaling is not possible, the least cost plan must be identified from among the alternatives considered.

b. It is not necessary to account for interest during construction in project costs for Section 14 authority projects.

6-16**1**. Publication of Planning Data, Information and Guidance. Various data used in planning and previously published yearly as an Engineering Circular, commonly known as the Fiscal Year 19xx Reference Handbook, will be **circulated** by HQUSACE by **economic guidance** memorandum as the individual data items become available. These data include:

a. Federal water resources discount rate;

b. Normalized agricultural prices;

c. Unit day values for recreation;

d. Areas eligible for NED benefits from employment of previously unemployed labor resources;

e. National Flood Insurance Program operating costs;

f. List of contacts for Corps of Engineers when seeking National Marine Fisheries Service (NMFS) input on measuring commercial fishing benefits; and

g. Vessel operating cost estimates.

h. Ability-to-pay factors for qualifying counties and counties eligible for price reductions on water storage contracts.

6-16**2**. Shore Protection. This paragraph provides general principles for evaluation of benefits from hurricane and storm damage protection projects.

a. Systems Analysis. Because shoreline processes are dynamic, shore protection measures may generate both beneficial and adverse impacts beyond immediate project sites. Impacts elsewhere may occur as a consequence of the design and implementation of site specific hurricane and storm damage reduction projects, and navigation projects may impact or be impacted by such projects. These impacts must be evaluated, and this requires expansion of the study area to include reaches adjacent to the project site. Generally, the adjacent reaches are bounded by natural features that interrupt or substantially limit the natural littoral processes (e.g., bays, sounds, inlets, geomorphic features, etc.). For studies which may not require a full systems approach, the justification shall be documented in the feasibility report. A systems analysis approach will include the following components:

(1) Physical processes. Develop a sediment budget for the segment of coast under investigation based on modeling of sediment movements, empirical data, and estimates of gross and net shoreline change rates over the past fifty year period, as well as rates of change during the most recent decade. Ascertain the effects and probability of occurrence of relevant storm events. Identify the magnitude of the average annual volumetric changes in beach area and volume.

(2) Coastal alterations. Identify man-made alterations to the shore (jetties, sand-bypassing and recycling, dredging, seawalls, groins, breakwaters, beach nourishment, etc.) and estimate their contribution to the balance of littoral processes and shoreline changes. This information, and knowledge of the physical processes, establishes the historical and existing conditions.

(3) Forecast shoreline changes. Forecast shoreline changes (including changes in nourishment requirements, if appropriate) and navigation related dredging requirements for the economic life of the proposed measure. Forecast this for future without and with project conditions.

(4) Economic benefits and costs. Inventory potential damage centers and locations of other project induced benefits or costs. For without and with project conditions estimate the costs of maintaining shore protection and navigation projects. At the project site and other impacted sites assess the extent of damages to property through analysis of storm surge and wave damage; assess changes in recreation (if any); and evaluate project impacts to jetties, channels and other navigation features.

***** b. Other Data Source. Additional detailed support material for conducting benefit evaluation procedures for prevention of coastal storm damage and erosion is in IWR report 91-R-8, dated August 1991. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained in the IWR report. *

c. Risk Analysis. Extensive research has been completed on risk-based analysis in Hurricane and Storm Damage Reduction Studies. Further information on research findings and analytical frameworks are available upon request from CECW-PD. Pending release of an ER on the subject, Districts performing these studies are required to adopt a life cycle analytical approach and provide probabilistic display of benefits and costs. Variables from the below list which have the greatest impact on plan formulation should be explicitly incorporated in the analysis.

(1) The erosion damage function (with special emphasis on structure values and land values)

(2) The stage-damage function (with special emphasis on structure first floor elevation, content and structure values.

(3) The wave-damage function by structure class

(4) Storm-related parameters such as peak wave height and period storm duration, peak surge elevation, and timing with respect to tidal phasing

(5) Wave height above the dune

(6) Wave penetration

(7) The shoreline retreat or eroded volume

(8) The natural post-storm recovery

6-16**3**. Power (Hydropower). See paragraph 6-15**7**, Most Likely Non-Federal Alternative.

6-1**64**. Navigation: Small Boat Harbors.

a. Introduction. Small boat harbor projects consist of Federal features (e.g. channels, breakwaters), usually in combination with non-Federal features (e.g. docks, ramps, berthing or mooring areas, dredging). Project outputs are enhanced access to recreational boating and sport fishing opportunities, and commercial fishing activities. Benefit estimation for recreation boating and sport fishing is conceptually no different than for other forms of recreation, and any benefit estimation method may be employed as long as it reflects NED criteria. Charter fishing craft, head boats and similar recreation oriented commercial activities are considered commercial vessels for cost allocation purposes by law. Provided commercial recreation activities are evaluated based on changes in net income to the owner/operator, project output will be considered commercial navigation benefits. This change in net income measure of benefits is appropriate only for existing vessels currently using harbor facilities.

b. Recreational Boating. Section VIII identifies three evaluation methods for recreational boating: travel cost, contingent valuation (survey method) and unit day values. All are acceptable for evaluating boating recreation benefits. The unit day value method is applicable subject to restrictions (see paragraph 6-**91d**.). The travel cost method employs expenditures associated with travel to and use of a resource as input data in determination of willingness to pay schedules. The contingent valuation method is a survey approach for determining willingness to pay. It can be

useful for a wide variety of evaluation problems, and can be particularly applicable in valuing changes in quality (e.g. improved access in and out of harbor due to provision of breakwater) where changes in the scale of a project are not substantial. Unit day values will ordinarily be chosen from the range of general recreation values (General Recreation or General Fishing and Hunting) although selection from the range of specialized recreation values (Specialized Fishing and Hunting and Specialized Recreation other than Fishing and Hunting) will sometimes be acceptable when participation in specialized activities is documented and other conditions of paragraph 6-11**4** are met. Reduction of damage to boats and facilities may be a component of benefits. If damage reduction benefits are estimated, care should be taken to avoid double counting of benefits if other benefit estimation techniques are also used.

c. Commercial Fishing. Section IX states that changes in net income to fish harvesters or boat operators is the appropriate measure of NED benefits. Two considerations, the habitat condition and the institutional setting, must be analyzed in planning reports. Reduction of damage to boats and facilities is frequently a component of commercial fishing benefits, and may apply as well to recreational boating. Reduced damages may be a part of the net income analysis or it may proceed as a separate analysis (e.g. damage reduced to public facilities not included in fish harvester's net income). It is frequently convenient to treat this damage on a probabilistic basis, i.e. product of probability of occurrence times dollar value of damage.

6-165. Major Rehabilitation. Major Rehabilitation projects began to be budgeted under Construction, General and Flood Control, Mississippi River and Tributaries (construction element) appropriation accounts beginning in FY 1993. Major Rehabilitation new starts have to compete with other types of new construction starts for scarce resources. To successfully compete as new starts, Rehabilitation Evaluation Reports and supplemental information sheets will have to provide a level of detail and evidence of criticality commensurate with other civil works new starts. The following steps outline generic procedures which can be used to evaluate major rehabilitation projects. Although these guidelines have primarily been used in evaluating hydropower and inland navigation projects, they are applicable to other project purposes.

a. Federal Interest. For the majority of cases, the Federal interest in an existing project will be obvious. However, reasonable argument which shows a Federal interest, and in some cases, a non-Federal interest (i.e. proposed cost sharing), will be provided in the report. Emphasis shall be placed on project outputs and whether they serve priority purposes as defined in the Annual Program and Budget request for Civil Works Activities, Corps of Engineers.

b. Base Condition. The base condition is the alternative which all other plans will be measured against. In comparison to other Corps planning studies, the base condition is synonymous with the "without project" condition. The base condition assumes that the project will be operated in the most efficient manner possible without the proposed rehabilitation. This treatment of the base condition is uniquely defined and applicable only to analysis of major Rehabilitation projects. Should the project benefit stream be interrupted due to unsatisfactory feature performance, it is assumed that emergency funds will be available to fix the feature. For the economic analysis, allowance must be made for the effect of the repair on the reliability of the feature. Considerable risk and uncertainty is inherent in the base condition. The timing, frequency, and consequences of system disruption are all unknown and must be estimated. The analysis should explicitly show the effects of reasonable alternative assumptions concerning these variables. Portray the base condition in the following manner.

Step 1. Based upon the reliability index calculated for the current physical condition select the probability of unsatisfactory performance for each feature, or component, from the Target Reliability Indices Table in the annual Major Rehabilitation Guidance. If the probability of unsatisfactory performance is due to a combination of events, provide the method used to determine these probabilities. Both the probability of unsatisfactory performance of a feature and the probability of occurrence of an event which results in load conditions causing the unsatisfactory performance shall be explicitly discussed and displayed. Reporting requirements to support the reliability analysis are also addressed in the Major Rehabilitation Guidance.

Step 2. Based on the existing physical condition of, and the current and forecasted demands on the features, estimate the frequency of service disruption and the physical consequences resulting over the planning period. Frequencies and consequences should be expressed in terms which are unambiguous and which facilitate analysis. For example, estimate the percent chance of disruption per year (annual probability) or probability of disruption per event (per event probability).

Step 3. Develop an event tree. A useful way of presenting information of alternative future pathways is an event tree diagram. The event tree is used to display the possible outcomes from some initiating event. Figure 1 is an event tree for a hydroelectric generating facility.

Step 4. Estimate all costs necessary to correct the service disruption. The repair should be the least cost fix necessary (as considered reasonable for the circumstances) to continue service.

Step 5. Estimate the economic cost for each disruption. (The economic cost for different project purposes should be calculated using the guidelines contained in other sections of this chapter)

Step 6. Combine the frequency of service disruption with the consequences of disruption. Monte Carlo simulation is one technique for combining risks and determining expected values. This technique is especially useful when the arithmetic of the expected value calculation is highly complex or intractable. Under some, perhaps many situations, the standard statistical procedure of summing the products of the probabilities and corresponding consequences is sufficient. That is, calculating the value analytically may be more expedient and transparent than estimating by simulation. An advantage of the Monte Carlo approach is that it yields both the expected value and the variance. The fundamental point of the analysis however, is to explicitly consider the likelihoods and consequences of the base condition.

c. With Rehabilitation Condition.

(1) General. As previously stated, the base condition should <u>not</u> describe an immediate or certain failure. Nor is the only project alternative immediate and full scheduled rehabilitation. There are a variety of intermediate strategies that should be evaluated. In addition, the rehabilitation decision must give consideration to the choice of timing and extent of rehabilitation. Therefore, the approach is to develop alternatives to solve the problems. This does not predetermine that one major rehabilitation scenario is the only alternative.

(2) Alternatives Considered. Discuss the alternatives considered. The narrative should address the level of detail developed for each alternative, the data available, assumptions made and the level of reliability, risk and uncertainty associated with the alternative. Present the results of the analysis for each alternative. The following represent some potential alternative plans that should be evaluated and compared.

(a) Advance maintenance strategy. Advance maintenance consists of expenditures in excess of routine O&M that reduces the likelihood of some emergency repairs and temporary service losses, or the rate of service degradation. Under this scenario, one must evaluate the effect that probabilities and consequences of the strategy have on expected service disruptions and reliability.

(b) Scheduled repair strategy. Assess the components of the feature in terms of the service disruption probabilities and consequences to the reliability of the structure. Based on this assessment, stockpile replacement parts and make other preparations on this assessment to reduce the time of expected project service disruption.

(c) Scheduled rehabilitation strategy. The scheduled rehabilitation strategy requires that the "optimum" rehabilitation timing be identified based on service disruption rates, service degradation and their economic cost.

(d) Immediate rehabilitation strategy.

d. Summary Statistics. Provide a table to illustrate the cost, benefits, net benefits and benefit to cost ratios of the base condition and each alternative considered.

SECTION XIV - FINANCIAL ANALYSES

6-1**66**. Purpose. This Section provides procedures and responsibilities for financial analysis in support of construction recommendations. It also provides guidance on the relationship between project outputs and non-Federal sponsors' ability to finance projects.

6-1**67**. Definitions.

a. Financial Analysis. A financial analysis consists of a non-Federal sponsor's statement of financial capability and financing plan and the district commander's assessment of the non-Federal sponsor's financial capability.

b. Financial Commitment. The financial commitment is the total financial obligation a non-Federal sponsor will be required to pay over the life of a project, including the acquisition of lands, disposal areas, easements, rights-of-way and relocations, the costs of operation, maintenance, repairs, replacements and rehabilitation (OM**RR**&R) over the life of the project, the cost of any associated work such as berthing areas for navigation projects or interior drainage for flood control projects, and the cost of debt service.

c. Statement of Financial Capability. The statement of financial capability is a clear and convincing description, submitted by the non-Federal sponsor, of its capability to meet its financial obligations for the project in accordance with the project funding schedule.

d. Financing Plan. A financing plan consists of a clear and convincing description of how the non-Federal sponsor plans to meet its financial obligations for the project in accordance with the project funding and OM**RR**&R schedules.

e. Assessment of Financial Capability. The district's assessment of the non-Federal sponsor's financial capability is to determine if it is reasonable to expect that ample funds will be available to satisfy the non-Federal sponsor's financial obligations for the project.

6-1**68**. General Financial Analysis Philosophy. Financial analysis is required for any plan being considered for Corps of Engineers implementation that involves non-Federal cost sharing. The ultimate purpose of the financial analysis is to ensure that the non-Federal sponsor has a reasonable plan for meeting its financial commitment. The financial analysis should include:

a. The non-Federal sponsor's statement of financial capability;

b. The non-Federal sponsor's financing plan; and

c. The district's assessment of the non-Federal sponsor's financial capability. Financial considerations can be expected to affect project scale as well as construction scheduling and phasing and OM**RR**&R expenses.

6-1**69**. Procedures and Responsibilities.

a. Specifically Authorized Projects. A financial analysis is required as part of the **Project** Cooperation Agreement (**P**CA) package to be submitted to HQUSACE. The analysis will include the

non-Federal sponsor's statement of financial capability supported by a financing plan, and the district commander's assessment of the non-Federal sponsor's financial capability. The financing plan and the statement of financial capability should be prepared by the non-Federal sponsor, with assistance from the district. If the replacement and rehabilitation costs are significant, the sponsor should be provided schedules and costs of occurrence for assistance in their overall financial planning.

b. Specifically Authorized Studies.

(1) Reconnaissance Phase. The reconnaissance phase is expected to provide an assessment of the level of interest and support of local interests in potential solutions. A letter from the non-Federal sponsor indicating his understanding of project cost sharing requirements should accompany the reconnaissance report. The letter should discuss, in general terms, the options available to the non-Federal sponsor for financing the non- Federal share of project construction. This information may be provided in the non-Federal sponsor's letter on study and project cost sharing.

(2) Feasibility Phase. The feasibility report should be accompanied by supporting financial information consisting of a preliminary financing plan and a statement of financial capability as described in paragraph 6-1**70**. It is recommended that this information be included in an appendix on local cooperation. This information is necessary to establish implementability.

c. Continuing Authorities Studies. Financial analysis, consistent with the complexity of the financing involved, is required for projects pursued under the authorities of Section 14, 103, 107, 205, and 208. The analysis will be documented in the Detailed Project Report (DPR). For most Continuing Authority Program projects, the financial analysis requirements can be satisfied by a statement of financial capability and financing plan in the form of a letter from the non-Federal sponsor and a short narrative in the Findings and Conclusions section of the DPR. This is particularly true when construction will be completed under one contract and the non-Federal cost share will be provided in advance of construction. In more complicated cases a preliminary capability statement, financing plan, and supporting financial information as described in paragraph 6-1**70** is required.

6-1**70**. Non-Federal Sponsor's Financing Plan and Statement of Financial Capability.

a. Scope.

(1) Financing Plan. Each financing plan should include the following information:

(a) A current schedule of estimated Federal and non- Federal expenditures by Federal fiscal year (see Table 6-35), including Federal expenditures, non-Federal contributions, non-Federal lands, easements, rights-of-ways, relocations, and disposal areas (LERR&D), and, for commercial navigation projects, non-Federal utility relocations. The total Federal and non- Federal shares displayed in the schedule should exactly reflect cost sharing policy and should agree with estimated cost figures in the **P**CA. Current cost sharing policy requires that the non- Federal funds (i.e. cash) be made available to the Federal Government in proportion to scheduled Federal obligations in each Federal fiscal year,

Table 6-35
Schedule of Estimated Federal and Non-Federal Expenditures

FISCAL YEAR	FEDERAL	NON-FEDERAL			
	CASH	LERR&D	UTIL.	RELOC.	OTHER

Notes:

1. Federal, Non-Federal cash and LERR&D should be shown for each project purpose.

2. Any repayment for navigation projects should be shown in a footnote.

3. Include in other any associated costs such as berthing areas or interior drainage.

except that the non-Federal share of prior costs (i.e. engineering and design costs) is to be recovered in the first year of construction.

(b) A schedule of the sources and uses of non-Federal funds during and after construction (see paragraph 6-1**72** and Table 6-36) by Federal fiscal year. The schedule should include project outlays and income as well as outlays and income related to project construction and financing. Outlays during construction include cash payments to an escrow account or the government; LERR&D; associated costs; and, for bonds, various insurance-related costs and interest paid to bond holders during construction. Income during construction includes funds on hand, revenues, appropriations, grants, interest on unexpended balances, and, for bonds, bond proceeds. Outlays after construction include bond debt service, repayments to the government, and OMRR&R. The schedule of the sources and uses of funds should be consistent with the schedule of estimated Federal and non-Federal expenditures.

(c) The method of finance for all non-Federal outlays including OMRR&R associated with the project should be explained in the financing plan.

(2) Statement of Financial Capability. The non-Federal sponsor's statement of financial capability should provide evidence of the non-Federal sponsor's authority to utilize the identified source or sources of funds; and each statement of financial capability should provide information on the non- Federal sponsor's capability to obtain remaining funds, if any. This information will be at a level of detail necessary to demonstrate such capability for the particular project and the particular non-Federal sponsor.

(a) Where the non-Federal sponsor's capability is clear, as in the instances where the sponsor has sufficient funds currently available or has a large revenue base and a good bond rating, the statement of financial capability need only provide evidence of such.

(b) If capability is not clear and the non-Federal sponsor is relying on its full faith and credit to obtain remaining funds (as in the use of general obligation bonds, appropriations or a repayment agreement), the statement of financial analysis should include a credit analysis which demonstrates that the sponsor is credit worthy for the required amount and purpose. A sample bond consultant's letter is at paragraph 6-1**87**.

(c) If the non-Federal sponsor is relying on non- guaranteed debt (e.g. a particular revenue source or limited tax, or bonds backed by such a source) to obtain remaining funds, the statement of financial capability should include an analysis that demonstrates that the projected revenues or proceeds are reasonably certain and are sufficient to cover the non-Federal sponsor's stream of costs through time.

(d) If the non-Federal sponsor is relying on third party contributions the statement should include comparable data for the third party together with evidence of it's legal commitment to the non-Federal sponsor.

b. Preparation.

Table 6-36
Schedule of Sources and Uses of Funds

FUNDS AVAILABLE FROM LOCAL SPONSOR

	Begin Balance Plus Annual Income	Required Annual Contribution	Fund Balance
Balance on hand const. init.			
1st year Revenues			
Interest Income			
Operating Revenues			
Bond Sales			
etc.			
2nd year Revenues			
Interest Income			
Operating Revenues			
Bond Sales			
etc.			
3rd year Revenues			
Interest Income			
Operating Revenues			
Bond Sales			
etc.			
.			
.			
.			
.			
.			
.			
Project Completion		0	

Required Annual OMRR&R 1/ =
Source of Funds for OMRR&R =

1/ Schedule of major replacement and rehabilitation costs should be included if they are significant cost items which sponsor must plan for.

(1) The district should, with input from the non-Federal sponsor, prepare the schedule of estimated Federal and non-Federal expenditures including OM**RR**&R.

(2) Either the non-Federal sponsor or the district should prepare the schedule of the sources and uses of non-Federal funds, using information provided by the other.

(3) Either the non-Federal sponsor or its financial consultant should prepare the financing plan and the statement of financial capability. The statement of financial capability should be signed by the appropriately empowered official representing the non-Federal sponsor.

(4) A financing plan and statement of financial capability should be prepared for each non-Federal sponsor which is signatory to an **P**CA (this applies to continuing authority projects as well as specifically authorized projects). If a non-Federal sponsor's financing depends on the contributions of funds by a third party or parties, and the non-Federal sponsor does not have the capability or authority to meet its financial obligations without said contribution, a separate statement of financial capability and financing plan should also be provided for the contributions for the third party or parties. These should include source of funds, authority and capability to obtain remaining funds, and evidence of the third party's legal obligation to provide its contribution.

(5) The financing plan and the statement of financial capability may be combined in one document.

6-1**71**. Assessment of the Non-Federal Sponsor's Financial Capability. The **district's** assessment of the non-Federal sponsor's financial capability should ascertain that it is reasonable to expect that ample funds will be available to satisfy the non-Federal sponsor's financial obligation for the project. **Districts are expected to present rationale supporting the conclusion of the assessment. Appropriate rationale would include discussion of prior performance of the non-Federal sponsor on similar projects, certainty of revenue sources and method of payment, the overall financial position of the non-Federal sponsor and/or the credit worthiness of sponsor's debt obligations as reported by an independent credit rating service such as Moody's or Standard & Poor's.**

6-1**72**. Illustration of Financing Plan Outline and Sample Bond Consultant's Letter.

a. Financing Plan Outline.

The (enter non-Federal sponsor's name), non-Federal sponsor of the (enter project name), is capable of meeting cost sharing and other obligations as required under the terms of the draft **Project** Cooperation Agreement.

USES OF FUNDS

(Status of land acquisition including an estimate of the cost of real estate interests that have not yet been acquired.)

(Total cash contribution required from the non-Federal sponsor for the project during construction

(Annual cash required from the non-Federal sponsor for operation, maintenance and rehabilitation.)

(Total cash required by the non-Federal sponsor for any project related requirements such as berthing areas for navigation projects and interior drainage for flood control projects.)

SOURCES OF FUNDS

(Cash available for project.)

(Financing to be obtained from bonds, if any)

(Financing to be obtained from other sources, e.g. operating revenues, tax revenues, interest earnings on funds dedicated to the project, etc.)

b. Sample Bond Consultant's Letter.

"We have been working with the (enter non-Federal sponsor's name) to develop a well-planned approach toward financing the pending project. In this regard the (enter non-Federal sponsor's name) has taken significant steps over the years in implementing certain actions designed to make the project financially possible. Among these are (list actions taken)."

"We have developed financial projections that indicate the (enter non-Federal sponsor's name) has the financial capability to complete the project. Bonds, in the amount of (enter amount) have been/will be authorized on (enter date) and the (enter non- Federal sponsor's name) current bond rating according to (enter source) is (enter bond rating)."

6-1**73**. Continuity of Financing Responsibilities.

a. Status of Local Sponsor's Financing Plan and Corps Responsibilities During PED. Between completion of the feasibility study and signing of the **P**CA the district commander shall keep informed and current regarding the continuing ability and willingness of the sponsor to meet its financial responsibilities. This time can be used to firm up any aspects of the financing plan which may have been weak. In addition, a mechanism shall be agreed upon whereby the sponsor will inform the Corps of any material changes in its financing abilities. Likewise, it is the responsibility of the district commander to inform the sponsor in a timely way of material changes in cost estimates resulting from PED studies, due to design changes for example.

b. Local Sponsor's Financing Responsibilities and Corps Responsibilities During Construction. Mutual responsibilities regarding information about financing abilities and changes in cost estimates continue after the **P**CA is signed and construction initiated. The district commander shall keep informed and current regarding the sponsor's continuing ability to meet its financial obligations, especially so if the financing plan calls for using other than cash or direct appropriations, or if the sponsor intends to repay its cost share. A mechanism shall be agreed upon whereby the sponsor will inform the Corps of any material changes in its financing abilities. The district

commander continues to be responsible for informing the local sponsor of changes in construction costs.

6-1**74**. Ability to Pay Determination. See ER 1165-2-121 for procedures for determining altered cost shares for qualifying non-Federal sponsors. The ER applies only to flood damage reduction studies.

6-1**75**. Relationship Between the Feasibility Study (Economic) Analysis and Financial Analysis. The primary purpose of the financial analysis itself is to ensure that the non-Federal sponsor has a reasonable plan for meeting its financial commitment. Project related economic analysis can provide data and other information potentially important in developing the financial analysis.

a. Relationship of Financing Plans to Project Outputs.

(1) Relationship of Project Outputs to Willingness to Pay. Project outputs create willingness to pay for the project on the part of direct beneficiaries equal to the total benefits. Frequently there are indirect beneficiaries. Both willingness' to pay are potentially capturable by the local non-Federal sponsor, and can become a part of the non-Federal sponsor's financing plan. For example, flood control for a business or commercial area has direct damages avoided benefits, and may improve the general business climate such that property values outside the flooded area increase as well.

(2) Financing Plan Alternatives. Some non-Federal sponsors will finance projects in a way that directly uses the "vendibility" of project outputs. Examples are port user charges or user fees for other project outputs, special taxing districts, property tax surcharges, etc. Some financing plans will be indirectly related to project outputs. For example the non-Federal sponsor's general taxing or bonding indebtedness capabilities may be used with the expectation that the project's beneficial effects will create ability to pay. Others will finance in ways entirely unlinked to the capturable value of project outputs. For example, the non-Federal sponsor may have sufficient funds available, a large revenue base or may rely on third party contributions.

b. Procedures. The role of economic analysis in development of financing plans is to establish relationships between project outputs, willingness' to pay on the part of direct and indirect beneficiaries and ability to finance projects.

(1) Outputs of projects (or use of project outputs) for which there are identifiable beneficiaries with willingness to pay that is potentially capturable should be quantified. The quantification should be to a degree of certainty that is useful to non-Federal sponsors in developing a financing plan (see Chapter 5, Section I, and various locations in this Chapter on risk analysis). Such information should provided in a form useful to non-Federal sponsors. Examples are: numbers, locations, values, and physical and use characteristics of structures to be protected by a flood control project; expected visitation at recreation facilities; vessel names, registries, ownerships, drafts and cargo carrying abilities of ships expected to benefit from harbor deepening, etc.

(2) Indirect effects of projects, e. g. local or regional development, should be identified and quantified to the degree practicable. Maximum use should be made of secondary sources (i.e. found in the literature) regarding average, or if available, location specific relationships between investment and induced economic activities, between investment and changes in property values, etc.

(3) Estimates of the willingness to pay of beneficiaries should be provided to local sponsors. These should be in a useful form and of a degree of certainty that is useful in developing financing plans. Examples are: average annual damages avoided for structures; willingness to pay for recreation visits; and transportation cost savings for the different beneficiaries identified in (1) above. If efforts to collect from beneficiaries would affect use of project outputs and the level of induced or secondary effects this information shall also be provided to local sponsors.

SECTION XV - COST ALLOCATION

6-1**76**. Purpose. This section states requirements for allocation of costs among the purposes served by a multipurpose project or plan.

6-1**77**. Requirements for Cost Allocations. There are two types of cost allocation studies: Preliminary cost allocations and firm cost allocations. This paragraph prescribes policies and requirements common to both. A cost allocation is required for any multipurpose project with a reimbursable project purpose.

a. General. Cost allocation studies shall identify specific facilities. The results of such studies shall be summarized to show the percentage of joint-use costs which, together with specific facilities costs, comprise the total allocation to each project purpose. Joint-use cost percentages are derived separately for construction expenditures and for operation and maintenance expenditures. Percentages for construction shall also be applicable to replacement and rehabilitation costs when these occur. As a general rule, percentages are to be rounded to the nearest tenth of one percent.

b. Responsibility for Cost Allocations. Allocation of total costs among purposes of a project is the responsibility of the Commander, USACE for projects planned and constructed under his jurisdiction. Where cost allocation is assigned by law to another Federal agency, HQUSACE will furnish cost data to such agency, together with views concerning appropriate allocation.

c. Purposes and Objectives to Which Costs Are Allocated. Preliminary cost allocations may allocate costs to all project purposes, recognized by current executive guidelines, which encompass the direct services or outputs of the project as recommended. In firm cost allocations reports, costs may be allocated only to the project purposes authorized by Congress, or those added under general authority.

d. Costs Included in the Allocation.

(1) Costs to be allocated include the total construction expenditures, value of lands and property transferred without cost to the project, interest during construction, operation and maintenance costs (including replacement costs necessary to maintain conditions as constructed throughout the project life).

(a) The cost allocation computation shall be computed on the basis of annual costs and benefits, with all expenditures and benefit accruals reduced to a common time basis and equivalent annual values over the period of analysis.

(b) Interest during construction is computed on expenditures during the construction period, in accordance with prescribed procedures for cost estimating or cost accounting requirements.

(2) Deferred costs shall be included in the allocation only if they are an integral component of the plan and its justification, and if they are integral to the investment decision to initiate construction. Deferred recreation costs and benefits dependent thereon (both discounted to the initial project operation date) which do not meet these criteria, may be included only if a cost-sharing contract, including designated future facilities and a construction schedule, is signed

and approved in advance of initiation of construction. If deferred costs are included the allocated costs should be presented in a breakdown as to initial and future costs.

(3) Funds allocated for preconstruction engineering and design (PED) prior to authorization are not included in project costs if the funds were obligated prior to 1 October 1985. Funds allocated for PED obligated on or after 1 October 1985 and all advance engineering and design funds shall be made a part of the cost allocated to project purposes and of the cost apportionment between Federal and non-Federal shares.

e. Costs Excluded from the Allocation.

(1) There are certain project costs included in the appropriations required for construction which by law or administrative regulation are excluded from economic analysis and shall not be allocated to the purposes of the water resources plan. These include the following:

(a) Highway betterments, pursuant to Section 208© of Public Law 87-874.

(b) Postauthorization costs of cultural resources mitigation, pursuant to Section 7 of Public Law 93-291, up to one percent of total funds authorized for appropriation, and costs in excess of one percent authorized by waiver pursuant to Section 208 of Public Law 96-515.

(2) Cost excluded from the allocation shall be shown in the allocation data by separate line item or footnote. The allocation data should identify the costs, including an appropriate share of Engineering and Design (E&D) and supervision and Administration (S&A), with sufficient information to permit a cost accounting determination consistent with the derivations in the cost allocation study.

f. Addition of Purpose to Existing Project (Completed or Under Construction). All added costs incurred by the addition of a new purpose shall be allocated to that purpose and a recommendation shall be made for approval by HQUSACE as to how all purposes should share in the joint-use costs of the original plan considering comparative benefit accruals over the new period of analysis.

6-1**78**. Preliminary Cost Allocation Studies.

a. Allocation Study Reported in the Feasibility Report. The preliminary cost allocation study is to provide information to those responsible for reimbursement as to the magnitude and share of reimbursable costs which may be part of the local cooperation requirements and to develop an estimate of Federal costs. Supporting allocation data should be in the detail comparable to other economic analyses in the planning report, and should be available for reviewing officers to verify the reasonableness of the cost allocation. These percentages from the preliminary cost allocation study in the feasibility report shall be used in budget presentations for initial funds for preconstruction planning and engineering, unless and until an updated preliminary allocation is completed during preconstruction planning and engineering, or as part of a restudy of an inactive or deferred project.

b. Cost Allocation Study in Preconstruction Planning and Engineering. The division commander shall determine the need for updating the preliminary cost allocation study. An updated preliminary cost allocation study shall be based on current cost allocation standards and other

planning and engineering studies current at the time of preparation. This cost allocation is particularly important for the following reasons:

(1) It provides the cost allocation data to be presented to local sponsors and other agencies as a basis for updated letters of intent or cost-sharing contracts required prior to initiation of construction.

(2) It provides the information on reimbursable and non-reimbursable costs to be included in budget presentations during implementation of a plan, until a firm allocation has been approved.

(3) It provides the information on allocated percentages of joint-use costs which will be used in project cost accounting until a firm allocation is adopted.

c. Coordination of Preliminary Cost Allocation Studies. Interagency Coordination of preliminary cost allocations shall be accomplished as deemed necessary by the commander, or as specifically required for project purposes.

(1) Coordination of preliminary and firm cost allocation studies with hydropower as a purpose is required with the marketing agency to permit its determination of financial feasibility. Preliminary coordination should be accomplished by the district commander, and final field level coordination is the responsibility of the division commander.

(2) In Reclamation States, the division commander shall insure that preliminary and firm cost allocation studies are coordinated with the regional office of the Bureau of Reclamation which has the responsibility for determining financial feasibility and repayment capacity for irrigation.

6-1**79**. Firm Cost Allocation Study.

a. Requirements of a Firm Cost Allocation. The firm cost allocation shall be prepared as a separate report. The report shall present a summary description of the water resources plan, its purposes, and operational characteristics in sufficient detail for a reviewer to understand the relationship between the derived allocation and the formulation objectives. The supporting tables shall present relevant data on benefits, costs, and derivation of the cost allocation.

(1) A firm cost allocation is required at the time the first reimbursable purpose of a multipurpose project becomes operational. However, because projects often become operational before final contracts are awarded and final real estate purchases are made, the division commander may authorize a delay of up to one year in submission of the firm cost allocation report. Authorization of longer delays must have the concurrence of the Director of Civil Works.

(2) A project will be nearing completion of construction when a firm cost allocation report is prepared. The report shall reflect the actual expenditures up to the time the firm allocation study is made and provide a schedule for any remaining estimated expenditures.

(3) Interest during construction will be computed in accordance with accounting practices (ER 37-2-10) which provide for interest from the middle of the month in which expenditures are made to the in-service date of the function or separable unit thereof. The in-service date is the first of the month following availability for service.

(4) Estimates of alternative costs required for the cost allocation shall be developed to a level of detail and to a scope consistent with the plan to be implemented.

(5) Benefits for all project purposes shall be adjusted to a price level representative of the period during which the project was constructed.

(6) The interest rate to be used in the firm cost allocation study is the project evaluation rate, established by applicable laws and regulation.

b. Review and Approval of Firm Cost Allocation Reports. The Chief of Engineers is the approving authority for firm cost allocation reports. The Division commander, however, has review and coordination responsibilities as follows:

(1) District commanders shall submit firm cost allocation reports to the Division commander for review and interagency coordination at the regional level.

(2) The division commander shall resolve all conflicts surfaced in review and coordination of the report, to the maximum extent feasible and shall forward the report with recommendations to HQUSACE (CECW-P). Division commanders are not to coordinate the report with the Federal Energy Regulatory Commission (FERC) regional offices. Formal coordination with FERC will be accomplished by HQUSACE.

(3) Upon adoption by the Chief of Engineers, notice will be given by CECW-P to CERM-FC and to the district and division commander. Retroactive adjustment of cost accounts will be made as required, in accordance with EP 37-2-1. The joint use cost percentages of the adopted report shall also be used for allocations of all remaining expenditures, for future additions, rehabilitations and replacements, and for operations and maintenance expenditures.

6-1**80**. Cost Allocation - Detailed Guidance. The remaining paragraphs of this section provide detailed guidance for and examples of allocation of cost among the purposes served by a multipurpose project.

6-1**81**. Definitions. The definitions presented in this paragraph are those specific to this section. General definitions of items, such as costs and benefits, are included in other sections of this regulation.

a. Alternative Costs. The costs of alternative projects with one purpose eliminated, to determine separable costs, or the costs of single purpose projects necessary to obtain the same benefits for the corresponding purpose as in the multipurpose project. The cost of the most economical alternative means for obtaining the same service for any one project purpose frequently is used as the measure of that project benefit. (See paragraph 6-157)

b. Cost Allocation. A systematic distribution of costs among the project purposes of a multipurpose project.

c. Joint-use Costs. Total project costs less all specific costs.

d. Joint-use Facilities. All project facilities which cannot be identified as specific facilities.

e. Joint Costs. The total project costs less the summation of separable costs. These are sometimes called "residual costs."

f. Separable Costs. Costs incurred to add a purpose to a project. These costs are normally calculated as a step in project (plan) formulation in considering the economic feasibility of including a purpose in a joint project. The separable cost is the minimum amount which should be considered for allocation to a given purpose. The separable cost for any specified purpose is determined by subtracting from the cost of the multipurpose project the cost of the most economical alternative project to obtain the same benefits for the other purposes with the specified purpose omitted.

g. Specific Costs. The costs of identifiable project features normally serving only one purpose, such as a powerhouse or switch yard. These costs are the total cost of identifiable project features for that purpose.

h. Specific Facilities. Identifiable project features normally serving only one purpose.

I. Total Costs. All costs for planning, design and construction of the project following completion of the feasibility report. These costs include the estimated value of all items transferred or furnished without cost to the United States government. Also included is accrued interest on these expenditures and values until the project becomes operational.

6-1**82**. Purpose of Cost Allocation. Cost allocations are made to derive an equitable distribution of project costs among authorized project purposes, or those proposed for authorization. Laws and regulations requiring reimbursement or cost-sharing generally specify recovery of costs incurred for the service or function. Cost allocation is, therefore, required for most multipurpose projects with a reimbursable purpose. An exception may apply where recreation is the only reimbursable purpose. Under present policy, reimbursement for recreation is limited to one-half of the separable costs. A complete cost allocation study normally would not be required to determine separable costs. However, it could be required to demonstrate that not more than 50 percent of project costs are allocated to recreation as required by Public Law 89-72.

a. The cost allocation is an essential part of the multipurpose planning process where cost-sharing will be required. It provides information needed to determine the magnitude and share of estimated project costs that are reimbursable. This information is essential to the tests of financial feasibility and plan acceptability. During subsequent planning and construction, it provides the information required for allocating actual expenditures and insures that cost accounts are maintained consistent with the plan formulation and allocation principles.

b. The significant outputs of the cost allocation study are the percentages for allocating joint-use costs among purposes. Although each allocation study derives the amount of cost allocated to each purpose (by cost of specific facilities and allocated joint-use cost), the amounts are pertinent only to the cost estimate used in the study. As total project costs change during the planning and construction phases, revised amounts allocated to each purpose are derived by application of the joint-use percentages contained in the allocation study.

6-1**83**. Purposes and Objectives to Which Costs Are Allocated. The recognized services which can be included in a Federal water resources project plan and to which costs may be allocated include the following: environmental quality, navigation, flood control, storm damage reduction, coastal erosion control, irrigation, power, water supply, recreation (including fish and wildlife recreation), fish and wildlife enhancement, streamflow regulation and, in limited cases, water quality. In some cases bank stabilization may also be included.

6-1**84**. Method of Cost Allocation.

a. The separable costs-remaining benefits method (SC-RB) of cost allocation was adopted by interagency agreement in March 1954 as the preferred method for allocating costs of Federal multipurpose water resource projects. Current Executive guidelines endorse its continued use. Under some circumstances, other methods may be used.

b. Under the SC-RB method, each purpose included in a project is allocated at least its separable costs, i.e., the incremental costs associated with including the purpose in the project. Benefits limited by alternative justifiable expenditures are the upper limit of allocation to each purpose. Remaining benefits (i.e., benefits in excess of separable costs) provide the basis for equitably apportioning joint costs among purposes. A description of the method, extracted from the "Green Book" on "Proposed Practices for economic Analysis of River Basin Projects," is presented in paragraph 6-2**04**.

6-**185**. Addition of Purposes to Existing Projects (Completed or Under Construction). The following guidance is provided for developing a cost allocation recommendation when purposes are added to an existing project:

a. General. Modification of existing projects to accommodate a new purpose may result from a change in planned operation at no additional cost, or from a physical addition to or modification of project facilities, or both. If the added purpose is reimbursable, or would have an effect on existing reimbursable purposes, the report in justification of the modification should include a determination of costs or charges to be assessed against the new purpose and any proposed reallocation of costs to existing purposes.

(1) The approach to be used in the analysis includes consideration of benefits of the new purpose, alternative costs to obtain the benefits, effects on benefits and revenues of existing purposes, change in project operation, reallocation of storage space, and changes in the physical scope and cost of the project.

(a) The significance of the added purpose should be clearly defined, both as to its benefits and its effects on all existing project outputs.

(b) A new period of analysis should be established when adding a project purpose. The period should be the lesser of the remaining physical life of the reformulated project, or 100 years from the time the purpose is added.

(c) Repayment period and interest rates should be discussed in the report setting forth the proposed addition of a reimbursable purpose. The repayment period should not exceed the new period of analysis, as established in accordance with a(1)(b) above. Normally, the interest rate will

be the current year project formulation rate when considering addition of a new purpose to a project. Exceptions should be cleared individually with HQUSACE (CECW-PD).

(2) The economic principles of evaluation and cost allocation are the same as those relating to the previously approved project analysis. Benefits form the addition of a purpose to an existing project must equal or exceed the incremental costs of adding the purpose. These latter costs also include the opportunity costs of the reduction in the beneficial outputs of the existing project as operated. Allocation of costs to the purpose should cover, as a minimum, any additional or incremental costs; the total cannot exceed the lesser of the benefits or the justifiable alternative expenditure.

(3) Two different procedures or approaches are acceptable for applying these principles to derivation of charges for added purposes. The first of these approaches sets forth guidance to be followed where addition of a purpose is of incidental significance, involving only minor losses to other purposes, and there is no change in plan scope (paragraphs 6-**187** through 6-**190**). The second approach deals with the addition of a purpose where the change is significant and the effect on other purposes creates a need for a new distribution of costs (c below). Use of these two approaches is applicable to addition of any purpose with the exception of deferred recreation facilities developed pursuant to **Section 5 of** Public Law 89-72 (paragraphs 6-**191** through 6-**197**) **at reservoir projects and Section 4 of the Flood Control Act of 1944, as amended, by Section 207 of the Flood Control Act of 1962 for non-reservoir projects**.

(a) These approaches do not require a determination of the extent to which originally allocated costs of existing purposes have been reimbursed or amortized. Status of reimbursement for existing purposes should be adjusted as required in cost accounts relative to any reallocation.

(b) In no case should costs allocated to existing purposes be increased unless the physical magnitude of their outputs has been increased by a change in project operation.

b. Addition of a Project Purpose with Insignificant **effect on the** Authorized **Project**. When the addition of a project purpose is incidental and has no significant effect on other project purposes, and the general scope of the project is not altered, a **cost allocation** need not be made. Consideration will be given to added benefits, incremental costs, and benefits foregone by authorized project purposes using current conditions and interest rates. A procedure for determination of price when reallocating an insignificant storage volume to water supply is included in paragraph 6-**190** and in Section VII, Water Supply.

c. Addition of a Purpose with Significant Effect on the Existing Project.

(1) When the addition of a new purpose entails identifiable costs and significant changes in expected benefits to other purposes, **a cost allocation** should be **performed**. Examples of situations that could require reallocation of costs are addition of power, addition of recreation which involves redistribution of storage allocations and not merely the addition of specific recreation facilities, or addition of water supply when it entails significant loss of flood control or other benefits.

(2) In addition to all modification costs required to add a new purpose to an existing project, joint-use costs equivalent to benefits foregone by pre-existing authorized project purposes should be assigned to the new purpose. These benefits and cost assignments should be computed using the

current year interest rate and benefit levels for all purposes. (Should this computation result in an annual cost exceeding annual benefits for the added purposes, it obviously would not be economically justified. Joint-use costs assumed by the new purpose would be at current price (benefit) levels, establishing equity for that purpose. Cost reductions to pre-existing authorized purposes would be in proportion to lost benefits which should be proportional to any repayment capabilities lost by these purposes). Every effort should be made to avoid modifications to existing cost-sharing contracts. If a contract is **impacted**, equity must be maintained.

6-**186**. Firm Cost Allocation Report. The format for the firm cost allocation requirement is presented at paragraphs 6-2**05** through 6-2**15**.

6-**187**. Cost Allocations for Specific Project Purposes: Water Supply.

a. Allocation of costs will be made in recognition of benefits and costs for future water supply that will be realized from storage included in the initially constructed plan.

b. Where a project provides for both immediate and future water supply, the amount allocated to the future use component should be presented. The ratio of this amount to total estimated construction costs should also be given to demonstrate that allocation to future use does not exceed 30 percent of total estimated project construction cost, which is a limitation imposed by the Water Supply Act of 1958.

6-**188**. Interest Rate for Cost Allocations: Water Supply. For water supply, the reimbursement rate may be different than the plan evaluation interest rate. The cost allocation study establishes the basis for allocation of construction costs to project purposes, and as such, the project evaluation interest rate should be used for the allocation. Cost accounts and reimbursement contracts should compute interest during construction and annual interest and amortization at the applicable reimbursement rate.

6-**189**. Cost Allocation Prior to Initiation of Construction: Water Supply.

a. Where water supply for immediate use is included in a plan, contracts should be executed with water users prior to initiation of construction or purchase of lands. Water users' responsibilities are fixed in terms of the percentages of specific and joint-use costs from the cost allocation report to be applied to actual cost as constructed.

b. In most cases, a cost allocation under these circumstances will be based on preconstruction planning and engineering studies. However, costs, benefits, and all other aspects of the project should reflect the latest approved estimates.

6-**190**. Addition of Water Supply to Completed Project. When addition of water supply is incidental and of no severe effect on other project purposes, and the project scope is not altered, **a cost allocation** should not be **performed**. Determination will be made as to appropriate charges for water supply. Adjustments to existing project purposes should be made by an internal bookkeeping credit as detailed in following subparagraph b. An example of appropriate charge determination when storage is reallocated is described below. Additional details are provided in paragraph 4-32 d. (2) of this regulation. This approach may be used on allocations for additions of other plan purposes, as

determined appropriate by the district commander subject to approval from HQUSACE. Questions on the use of this approach may be addressed to HQUSACE (CECW-P).

a. Price of Water Supply Storage. The cost to the non-Federal interests for reallocated storage is established as the incremental increase in operations and maintenance costs plus the highest of benefits or revenues foregone, replacement costs, or the updated cost of storage in the Federal project.

(1) Benefits Foregone. Benefits foregone are estimated using a standard Corps NED economic evaluation using a constant price level, the Federal discount rate, and conditions projected for the remaining economic life of the project or 50 years, whichever is greater.

(2) Revenues Foregone. Revenues foregone to hydropower are the reduction in revenues accruing to the U. S. Treasury, based on existing rates charged by the power marketing agency as a result of the reduction in the hydropower.

(3) Replacement Cost. For reallocations from hydropower, the long-term replacement cost of power should normally be the same as benefits foregone. In some instances, however, where the power marketing agency has existing contracts with their customers, the replacement cost of power may be determined by the estimated cost to the power marketing agency to obtain outputs from alternative sources to fulfill the Federal Government contractual obligations for the duration of the contracts. Once the contracts expire, the replacement cost of power should be equal to the benefits foregone for the remainder of the period of analysis.

(4) Updated Cost of Storage. The costs to be reallocated to the water supply storage are determined by first computing the costs at the time of construction by using the Use of Facilities cost allocation procedures as follows:

$$(\text{Total construction cost - specific costs}) \times \frac{\text{Storage reallocated (ac-ft)}}{\text{Total usable storage (ac-ft)}}$$

The cost allocated to the storage on this basis is then escalated to present day price levels. Costs are to be indexed from the midpoint of the physical construction period to the beginning of the fiscal year in which the contract for the reallocate storage is approved. By use of this procedure, interest during construction is eliminated from consideration. The cost of storage determined by this method is compared against the cost of the least costly alternative as determined in subparagraph (5) below. Based on this comparison, the FOA should recommend a cost for the water storage space, and provide justification for that recommendation. Operation, maintenance and major replacement costs should be computed annually by the Use of Facilities Method and added to the cost of the storage to determine the total yearly payment.

(5) Financial Feasibility. As a test of financial feasibility, the governing annual cost of storage derived as determined above should be compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water which the local interest would undertake in absence of utilizing the Federal project. This analysis is to be included in reports which request the reallocation of storage for municipal and industrial water supply.

b. Cost Accounts. All income and expenses (investment, operation, maintenance, and replacement) associated with the water supply function should be separately identified in the official cost account record. When there is a loss of revenue to existing purposes, or additional operation and/or maintenance expense to existing purposes are incurred because of the new water supply addition, such charges should be shown as a direct charge against the water supply function. This will effect the appropriate cost reductions in the existing project purposes and all revenues from the new addition will be credited to the new purpose.

c. Hydropower Credit. While existing signed contracts between the power marketing agency and their power customers are in force the power marketing agency may be given credit for the incremental increase in costs incurred to obtain power for these contracts (revenues foregone plus the incremental increase in the cost to purchase power, i.e. replacement cost). After the expiration of current contracts, the power marketing agency will be credited for the amount of revenues to the U.S. Treasury foregone as a result of the reallocation (as determined in (2) above assuming uniform annual repayment.

6-**191**. Cost Allocations for Specific Project Purposes: Recreation and Fish and Wildlife Enhancement. The allocation of recreation costs is made in light of the following:

a. Recreation developed as a purpose pursuant to Public Law 89-72 or by the project authorization will bear its full and equitable share of joint-use costs. However, if recreation development must be eliminated from initial project construction because of lack of sponsorship, its later addition does not require reallocation of a share of joint-use costs to recreation. Lands may be acquired for possible future recreation and fish and wildlife development pursuant to Section 3 of Public Law 89-72. No lands, however, will be acquired under this authority unless a non-Federal public body has agreed to the same **project** cooperation requirements applied to all recreation lands and facilities.

b. The inclusion of recreation in a plan pursuant to authority of the 1944 Flood Control Act does not constitute a purpose to which joint use costs are allocated. Only the cost of specific facilities and any other related costs specifically for recreation may be allocated to recreation in these cases, unless a project reformulation has been presented to Congress with costs otherwise allocated.

c. Exceptions may be made for projects not yet constructed, if recreation is proposed as a purpose in postauthorization planning prior to the initiation of construction. These cases should be brought to the attention of the HQUSACE with a revised project reformulation and preliminary cost allocation report incorporating allocation of costs to recreation as a purpose.

6-**192**. Lake Recreation Benefits. Recreation, sports fishing and wildlife enhancement, which are derived primarily from availability and use of the lake, should be treated as a single purpose in the cost allocation process, if required to properly identify separable lake costs for their common use. Suballocation of separable costs should be made as necessary to identify cost-sharing requirements for different sponsors.

6-**193**. Downstream Benefits: Recreation and F&WL. Recreation and fishery benefits accruing downstream as a result of lake releases are not usually associated with the plan formulation and operational aspects that produce the lake recreation and fishery. When they are, derivation of an

equitable apportionment of costs for these benefits would require separate consideration. The total allocation to recreation would then be presented as a combination of the two separately determined amounts. Information on plan formulation which is pertinent to the cost allocation process will dictate when this approach is to be utilized.

6-**194**. Fish Mitigation Benefits. Fishery mitigation facilities required by plan construction are not a specific or separable cost of fishery enhancement. Even though enhancement may be realized incidentally from mitigation facilities, the separable enhancement costs calculated by SC-RB procedures are limited to incremental facilities for enhancement over and above mitigation requirements. Contributions of mitigation facilities to realization of enhancement benefits is recognized in the allocation of separable and joint costs to the enhancement purpose.

6-**195**. Addition of Recreation and Fish and Wildlife Enhancement to Completed Projects. The provisions of **Section 5 of** Public Law 89-72 permit acquisition of lands for deferred recreation and fish and wildlife enhancement development at reservoir projects. These lands will be acquired only if a non-Federal entity agrees, prior to acquisition, to local cooperation and cost sharing requirements applied to all recreation lands and facilities. Further authorization is not required if facilities are subsequently developed. Federal costs of lands and facilities are allocable to recreation and fish and wildlife, and these are subject to cost-sharing requirements as specified by Public Law 89-72. The repayment obligation begins at the time non-Federal sponsors sign a contract indicating their intent to meet the cost-sharing requirements. In plans where only this type of development is added, no joint-use costs are to be allocated. However, if a modification to the dam and lake is proposed, all modification costs for the purpose of adding recreation and fish and wildlife enhancement to the project are chargeable to the added purpose.

6-**196**. Interest Rate: Recreation. The reimbursement rate for recreation may be different than the project evaluation interest rate. The cost allocation study establishes the basis for allocation of construction costs to project purposes, and as such, the project evaluation interest rate will be used in its preparation. Cost accounts and reimbursement contracts will compute or recompute interest during construction, and annual interest and amortization, at the applicable reimbursement rate.

6-**197**. Incidental Fish and Wildlife Enhancement. Costs should not be allocated to fish and wildlife enhancement if such enhancement is not an authorized project purpose and the benefits to fish and wildlife are incidental to meeting other project purpose goals.

6-**198**. Cost Allocations for Specific Project Purposes: Hydroelectric Power. Cost allocations for multipurpose projects with hydroelectric power should be coordinated with the Federal Energy Regulatory Commission (FERC). This will usually be in the form of a proposed cost allocation report. The Corps should also provide FERC with information to assist FERC in its responsibilities for specifying charges in its permits and licenses.

6-**199**. Annual Notification of Power Marketing Agency. The appropriate power marketing agency should be notified annually as to the amount of credit, if any, that should be deducted from power reimbursement requirements based on adjustments in cost accounts (paragraph 6-**190**b).

6-**200**. Construction Period and Price Level for Alternative Power Projects. The construction period for alternative power projects should be the average period for projects of the type and size used in the FERC analysis to determine economic benefits. The price level for the power alternative in firm

cost allocations should be at a point in time one-half of the alternative project construction period back from the initial power-on-line date. The price level used in preliminary cost allocations should be the latest available.

6-2**01**. Cost Allocations for Specific Project Purposes: Navigation Projects Producing Commercial, Recreational and Land Enhancement Benefits. The costs of specific or separable project features will be allocated to the purposes served. The costs of jointly used general navigation facilities producing commercial, recreational, or land enhancement benefits, will be allocated to each use in proportion to the remaining benefits expected to accrue to each use. Thus, the costs of breakwaters would be allocated to commercial and recreational navigation, and the cost of dredging to these uses and to land enhancement as well.

6-2**02**. Cost Allocations for Specific Project Purposes: Mitigation Cost-Sharing. In the general case of multipurpose projects, for which all project costs are allocated by the separable costs-remaining benefits method (SC-RB), the mechanical procedures which lead to appropriate mitigation cost-sharing conforming to our policy are not susceptible to appreciable variation. The annual costs for mitigation measures are entered into the computations along with the annual costs for all other project features, and when these have been allocated to the several purposes the several increments of annual costs are translated back into their first cost and annual operation and maintenance (or management) cost components. These are then apportioned to Federal and non-Federal interests based on the established legislative and policy requirements for each individual purpose.

6-2**03**. Single Purpose Procedures. In the case of single purpose projects (navigation or flood control) which, on the surface, are simpler because they do not involve any elaborate allocations of costs to purposes, future reports should use the following procedure:

a. Basic project costs (less mitigation)--first costs and annual operation, and maintenance**, repair, rehabilitation and replacement** costs--will first be apportioned to Federal and non-Federal sponsors based on the established legislative and policy requirements for the project purpose.

b. The Federal/non-Federal percentages for sharing mitigation costs will then be determined on the basis of the respective sums of basic project costs apportioned to each entity: first costs plus the capitalized (present worth) value of annual operation, maintenance**, repair, rehabilitation and replacement** costs.

c. These percentages will then be applied to the sum of estimated mitigation costs: first costs for mitigation measures plus the capitalized value of annual operation, maintenance, **repair, rehabilitation and replacement** (or management) costs for the mitigation plan.

d. The Federal/non-Federal share of mitigation first costs will then be adjusted as appropriate depending upon which entity is assigned actual performance of operation, maintenance, **repair, rehabilitation and replacement** (or management) for mitigation; that entity receiving credit, against its apportioned responsibility for total mitigation costs, for the capitalized value of the estimated costs for the annual work it will perform.

6-2**04**. Separable Cost-Remaining Benefit Method. This recommended method of cost allocation is extracted verbatim from:

"Report to the Inter-Agency Committee on Water Resources, Proposed Practices for Economic Analysis of River Basin Projects", (The "Green Book", prepared by the Subcommittee on Evaluation Standards, May 1958).

"The separable costs-remaining benefits method of cost allocation is a method for obtaining an equitable distribution of the costs of a multiplepurpose project among the purposes served. Briefly, it provides for: (1) assigning to each purpose its separable costs, i.e., the added costs of including the purpose in the project; and (2) assigning to each purpose a share of the residual or remaining joint costs in proportion to the remaining benefits; i.e., the benefits (as limited by alternative costs) less the separable costs. Thus, the method provides for an equitable sharing among the purposes in the savings resulting from multiple-purpose development.

"The separable costs-remaining benefits method described in detail below is recommended for general use in allocating costs of Federal multiple-purpose river basin projects. It differs from the generally recognized benefits method in that the amount of benefits used as a basis for the allocation in the recommended method is limited by the costs of available single-purpose alternative projects. In this respect it resembles closely the alternative justifiable expenditure method, except that the concept of specific costs for each purpose is replaced by the concept of separable costs for each purpose. The separable costs for each purpose are determined as part of the procedures recommended herein for project formulation, so that no added work should be required by this method of cost allocation. Since separable costs include all specific costs and generally include other added costs, residual joint costs to be allocated are usually smaller under the separable costs-remaining benefits method than under the alternative expenditure method. Thus, the separable costs-remaining benefits method maximizes the direct allocation of costs and minimizes the residual costs to be apportioned.

Description of Method

"The method consists of (1) determining the separable cost of including each function in the multiple-purpose project, and (2) determining an equitable distribution of costs incurred for several purposes in common. It makes allowance for any economic significance attributable to the peculiarities of any one purpose in its use of facilities or its prior right to project services. Thus, the use of benefits as a basis for cost allocation under this method makes allowance for both the use made of conditions assumed with respect to those factors. Furthermore, the separable costs determined through project formulation reflect the costs of providing facilities used by each purpose as explained more fully below.

"Separable Costs. The separable cost for each project purpose is the difference between the cost of the multiple-purpose project and the cost of the project with the purpose omitted. Separable costs include more than the direct or specific costs of physically identifiable facilities serving only one purpose, such as an irrigation distribution system. They also include all added costs of increased size of structures and changes in design for a particular purpose over that required for all other purposes, such as the cost of increasing reservoir storage capacity. In effect, separable costs are computed from a series of project cost estimates, each representing the multiple-purpose project with one purpose omitted. Such information will be readily available when the recommended practices of project formulation

have been followed. Where project formulation has not been of the detail suggested in the recommended procedure and separable costs are not available, specific costs may be used in lieu of separable costs (as in the alternative justifiable expenditure method).

"Distribution of Residual or Remaining Joint Costs. Residual costs are here defined as the difference between the cost of the multiple-purpose project as a whole and the total of the separable costs for all project purposes. Residual costs thus represent a remaining joint cost attributable to all or several purposes. The amount of project benefits used as a basis for allocation of residual costs to any purpose is limited by the cost of providing equivalent services from the most likely economically feasible alternative source available in the area to be served. From such benefits for each purpose, separable costs are deducted to give remaining benefits. Then residual costs are distributed in proportion to the remaining benefits for each purpose. The distribution of residual costs in proportion to the excess of benefits over separable costs assigns to each purpose an equitable share of project savings.

"If the total separable costs of all purposes should exceed the cost of the multiple-purpose project, there are in effect no residual costs as defined above, but rather a joint saving, which can be distributed among purposes by reducing separable costs to obtain the allocation to each purpose instead of by adding a portion of residual costs to each separable cost as illustrated herein.

"Total Allocation. The sum of the separable costs and the allocated residual cost for each purpose constitutes the total allocation to that purpose. Under the separable costs-remaining benefits method, the total cost allocated to each purpose will not be less than the cost of including that purpose in the project (unless the total of separable costs for all purposes exceeds the multiple-purpose project costs as explained in preceding paragraph), and will not be more than the benefits of that purpose or the cost of the most economical single-purpose alternative."

6-2**05**. Reporting Requirements: Firm Cost Allocation Study. This paragraph and following paragraphs 6-2**06** through 6-2**15**, with tables 6-37 through 6-47, provide the format for the firm cost allocation report. Give name of project and location by river, State and nearby community. Indicate current status; as under construction, in operation, etc. Cite purposes of project to which costs are allocated.

6-2**06**. Plan of Improvement.

a. Authorized Plan. Review authorizing legislation for the original plan of improvement and subsequent authorizations which modify the scope. The outline should fully cover any aspects of project authorization which have a bearing on the allocation of costs to the various purposes. Pertinent parts of authorizing legislation and recommendations in project documents should be referenced.

b. Related Improvements. If the project is a unit in an overall development, its relationship to other units in the plan should be described. Modifications in purposes and operations contemplated when additional units in the plan are added should be explained to the extent that they are pertinent to the allocation of costs. The relationship of the project to upstream or downstream developments which have been constructed, or which are proposed for construction by

others, should be outlined. If any payment for downstream benefits pursuant to the provisions of the Federal Power Act is anticipated, explain how such prospective payments have been taken into account in the cost allocation. Refer to drawing(s) included with the studies showing locations of the project and related improvements.

c. Operational Requirements. Outline the manner in which the project is to be operated to achieve the various objectives, describing the requirements for, and relationships of, the individual purposes as they pertain to such operation. Include explanation of any use to be made of seasonal or multiple use storage, and limitations to be imposed on operations for the various purposes.

Table 6-37
Cost Allocation Report: Lake _____

Item	Unit	Multiple-purpose Project	Alternative single-purpose project	Alternative multiple-purpose projec	
		(as constructed)	Power	With power	Without floo control
General					
Location:		Middle Fork Willamette R.	Middle Fork Willamette R.	Middle Fork Willamette R.	Middle Fork Willamette R.
River mile above mouth of Middle Fork Willamette	mile	47.8	47.8	47.8	47.8
River mile above Lookout Point Dam	mile	26.5	26.5	26.5	26.5
Drainage area	mile	389	389	389	389
Reservoir					
Elevation:					
Full & maximum pool	ft. MSL	1,543	1,536	1,524	1,541
Flood control pool	ft. MSL	1,543	--	1,524	--
Maximum conservation pool	ft. MSL	1,541	--	1,522	1,541
Maximum secondary flood control pool	ft. MSL	1,480	--	--	--
Minimum flood control pool	ft. MSL	1,448	--	1,414	--
Minimum power pool	ft. MSL	1,414	1,411	--	1,_____
Stream bed at dam axis	ft. MSL	1,244	1,244	1,244	_____
Minimum tailwater	ft. MSL	1,223	1,223	1,223	_____4_
Reservoir area:					
Maximum pool	acre	2,735	2,650	2,480	1,244
Flood control pool	acre	2,735	--	2,480	1,223
Conservation pool	acre	2,715	--	2,450	
Maximum secondary flood control pool	acre	1,930	--	--	2,715
Minimum flood control pool	acre	1,575	--	1,320	--
Minimum power pool	acre	1,325	1,300	--	2,715
Storage capacity:					--
Total	acre-foot	356,000	337,000	307,000	--
Flood control, primary	acre-foot	145,000	none	200,000	1,325
Flood control, secondary	acre-foot	55,000	--	--	
Power	acre-foot	49,000	233,000	none	350,600
Dead + inactive	acre-foot	107,000	104,000	107,000	--
Summer flood control	acre-foot	5,400	--	5,400	--
					243,600
Dams and Appurtenances					107,000
Dam:					--
Type		Earth and gravel fill	Earth and gravel fill	Earth and gravel fill	
Elevation, top of dam	ft. MSL	1,548	1,541	1,529	
Length	feet	2,150	2,135	2,105	Earth and
Height (from stream bed)	feet	304	297	285	gravel fill
Spillway:					1,546
Type					2,135
Elevation of crest	ft. MSL	Gated chute	Gated chute	Gated chute	302
Number of gates		1,495.5	1,486.7	1,476.5	
Size of gates	feet	3	3	3	
Spillway design flood (reservoir inflow)	c.f.s.	42x47.5	42x49.3	42x47.5	Gated chute
Spillway design capacity	c.f.s.	151,000	151,000	151,000	1,491.7
	c.f.s.	141,600	151,000	141,600	3
					42x49.5
					151,000
					151,000

Pertinent Data

Table 6-37 (Continued)
Cost Allocation Report: Lake _____

Item	Unit	Multiple-purpose Project	Alternative single-purpose project	Alternative multiple-purpose pr	
		(as constructed)	Power	With power	Without flooc
Fish Facilities:					
At site		None	None	None	None
At existing Leaburg Hatchery		Added ponds	Added ponds	Added ponds	Added ponds
Outlet conduits:					
Type		Tunnel	Pipe	Tunnel	Pipe
Diameter of tunnel or pipe (bypass)		12'9"	2'0"	13'9"	2'0"
Operating gates (on bypass valve)	each	2-6'6"x12'6"	1-24"	2-6'6"x12'6"	1-24"
Emergency gates (on bypass valve)	each	2-6'6"x12'6"	1-24"	2-6'6"x12'6"	1-24"
Penstocks:					
Number		1	1	--	1
Diameter	feet	12	12	--	12
Power Plant					
Powerhouse:					
Type		Indoor	Indoor	--	Indoor
Dimension		55'3"x118'6"	55'3"x118'6"	--	55'3"x118'6'
Installed capacity:					
Number of generating units		2	2	--	2
Capacity of units, each	KW	15,000	15,000	--	15,000
Installed capacity	KW	30,000	30,000	--	30,000
In-service dates:					
1st unit		May 1962	May 1962	--	May 1962
2nd unit		May 1962	May 1962	--	May 1962
Power Data					
Operating gross heads:					
Maximum	feet	317	310	--	315
Minimum	feet	188	185	--	186
Net regulated flow:					
Average critical period net power flow	c.f.s	746	724	--	
Power available (31 months)					
Continuous power, critical hydro. period	KW	13,100	13,100	--	
Dependable power, critical hydro. period	KW	16,400	16,400	--	
Minimum peaking capability	KW	24,200	24,200	--	
Primary energy per year	KWH	114,756,000	114,756,000	--	114,
Total energy per year	KWH	162,279,000	162,279,000	--	162,
Load factor critical period	Percent	80	80	--	

Table 6-38
Cost Allocation Report: Lake _____
Summary of Construction Expenditures

Permanent features	Multiple-purpose project (as constructed)		Total cost	Alternative single-purpose project	Alternative multiple-p projects	
	Power	Joint use cost		Power	Without power	Witl c
Lands and Damages	--	$743,000	$743,300	$743,300	$715,300	
Relocation	--	9,858,200[4]	9,858,200	9,761,200	9,593,200	
Reservoirs	--	1,024,300	1,024,300	992,300	928,800	
Dams	$3,137,600	26,946,800	30,084,400	25,709,500	24,025,900	2(
Main dam		(21,947,900)	(21,947,900)	(22,505,900)	(21,207,900)	(23
Outlet works (exclusive of power		(2,943,900)	(2,943,900)	(66,000)[3]	(2,263,000)	
Power intakes works	(3,124,600)	--	(3,124,600)	(3,124,600)	--	(3
Domestic and powerhouse fire protection water supply inlet	(13,000)[1]	(55,000)[2]	(68,000)	(13,000)	(55,000)[2]	
Fish Facilities (for mitigation)	--	140,500	140,500	140,500	140,500	
Power Plant	3,412,000	--	3,412,000	3,412,000	--	
Roads, Railroads, And Bridges	--	130,500	130,500	130,500	70,000	
Buildings, Grounds, And Utilities	--	227,800	227,800	227,800	227,800	
Permanent Operating Equipment	--	97,100	97,100	72,100	64,200	
Project Cost[2]	$6,549,600	$39,168,300	$45,717,300	$41,118,000	$35,765,700	$4
Credit						
Transfer of property without cost	300	-17,600	-17,300	--	--	
Total Expenditure of Property Without Cost	$6,549,900	$39,150,700	$45,700,600[4]	$41,118,000	$35,765,700	$4

Note: The alternative single-purpose flood control project is substantially the same as the alternative multiple-purpose project without power, as shown above. The alternative multiple-purpose projects without irrigation and without navigation are identical to the overall multiple-purpose project shown above.
[1]Fire protection facilities.
[2]Water supply facilities for possible future use.
[3]Increased size of bypass pipe (for conservation releases) 20" to 24".
[4]Exclusive of $500,000 non-allocable highway improvement costs.

Table 6-39 Cost Allocation Report: Lake _____
Interest During Construction - Specific Power Facilities

Table 6-40
Cost Allocation Report: Lake _____
Interest During Construction - Joint-Use Facilities

Period			Expenditures					
Beginning D.M.Y.	End D.M.Y.	During Period	During Period	At Beginning of Period		Interest During Period	At Beginning of Period	
				Total			In Operation	Interest Bearing
					Dollars			
010352	300652	6,927						
010752	300653	37,277			6,927			6,927
010352	300652	40,044				166		
010753	300654	44,204	40,044	40,044				
010752	300653	215,459			40,044	3,694		44,204
010754	300655	65,130	255,501	255,501		7,898		65,130
010753	300654	120,951			255,501			
010755	300656	87,400	376,454	376,454		11,020		87,400
010754	300655	128,727			376,454			
010756	300657	127,140	505,176	505,176		16,798		127,140
010755	300656	333,567			505,176			
010757	300658	260,830	838,741	838,741		47,198		260,830
010756	300657	2,098,401			838,741			
010758	300659	550,271	2,937,144	2,937,144		426,075		550,271
010757	300658	7,420,851			2,937,144			
010759	300660	645,419	10,365,995	10,365,995		684,509		645,419
010758	300659	13,354,128			10,365,995			
010760	300661	2,842,562	23,720,123	23,720,123		846,149		2,842,562
010759	300660	7,300,960			23,720,123			
010761	301161	5,486,289	31,040,759	31,040,759		385,954		5,486,289
010760	300661	5,610,555			31,040,759			
011261	300562	6,193,207	36,651,314	36,651,314		103,828[2]		6,193,207
010761	300562	800,654			36,651,314			
010762	300663	7,978,312-	37,451,968	37,451,968				
010662	300662	6,454,394			37,451,968			
010763	300664	1,052,173-	38,116,125	38,116,125				
010662	300662	651,222			38,116,125			
010764	300665	683,236-	38,212,437	38,212,437				
010763	300664	6,525,036			38,212,437			
010765	300666	24,564-	38,485,062	38,485,062				
010764	300665	6,530,932			38,485,062			
010352	000000	32,014-	39,136,284	39,136,284				
010765	300666	6,549,585			39,136,284			
010352	000000	6,549,600	39,166,676	39,166,676				
Total specific cost, both power units			39,168,300					

[1] Total specific cost, both power units

[2] In-service, functions other than power:

.7525 x 39,169,300 = 29,474,656

[3] Interest during construction of joint-use facilities other than power

Interest to date: 2,595,700

29,474,000 x $2,595,700 - $2,042,800
37,452,000

[4] Interest during construction of joint-use facilities chargeable to power

49,600 x $2,595,700 - $2,042,800 = 82,162
1,622--

[5] Both power units to service

INOPERATION DATES OF FACILITIES
Power Units Nos. 1 & 2 1 June 1962
Function other than power
1 December 1961

Trial percentages for allocation of joint costs:

Functions other than power	75.25%
Power	24.75%

INOPERATION DATES OF FACILITIES - Power Units Nos. 1 & 2 1 June 1962

Table 6-41 Cost Allocation Report: Lake _____
Summary of Annual Operation & Maintenance and Replacement Costs

Table 6-42

	Multiple-purpose project				Alternative mult proje
	Specific Costs				
	Power	Control	Joint use	Total	Without power
Operation and Maintenance					
Dam, Reservoir	--	--	$26,000	$26,000	$26,000
Real Estate Management	--	--	1,000	1,000	1,000
Roads, Railroads, and Bridges	--	--	1,000	1,000	1,000
Buildings, Grounds, Utilities, Operating Equipment	$3,000	--	8,000	11,000	8,000
Power Plant	28,000	--	--	28,000	--
Fish and Wildlife Facilities	--	--	18,000	18,000	18,000
Condition and Operation Studies	3,000	$2,000	20,000	25,000	20,000
Supervision, Administration, and Reports	3,000	1,900	5,000	9,900	5,000
Surveys and Layouts	--	--	1,000	1,000	1,000
Subtotal - Operation and Maintenance	$37,000	$3,900	$80,000	$120,900	$8,000
Major Replacements	14,000	--	7,000	21,000	7,000
Total	$51,000	$3,900	$87,000	$141,900	$87,000

[1]Also applicable to the alternative single purpose power project.

Cost Allocation Report: Lake _____
Summary of Costs, Charges, and Benefits

	Multiple-Purpose Project[3]	Alternative Projects		
		Single Purpose	Multiple-Purpo	
	Total	Power	Without Power[1]	V
Construction Costs	$45,717,900	$41,118,000	$35,765,700	
Interest During Construction				
Specific facilities costs				
Power	324,100	2,677,000	--	
Joint-use facilities	2,699,700	--	2,365,500	
Total	3,023,800	2,677,000	2,365,500	
Federal Investment	48,741,700	43,795,000	38,131,200	
Average Annual Charges				
Interest and amortization	1,718,600	1,544,200	1,344,500	
Operation and maintenance	120,00	111,000	80,000	
Major replacements	21,000	20,600	7,000	
Total	1,860,500	1,675,800	1,432,500	
Average Annual Benefits				
Flood control	3,945,000	--	3,945,000	
Irrigation	258,100	--	258,100	
Power	793,500	793,500	7,000[2]	
Navigation	33,500	--	33,500	
Recreation	167,000	--	167,000	
Total	5,197,100	793,500	4,410,600	
Benefit-to-Cost Ratio	2.79 to 1			

[1]Alternative single-purpose flood control project would be the same as the multiple purpose project without power.
[2]Downstream power.
[3]Exclusive of non-allocable highway improvement costs: construction $500,000; investment $530,000; interest and amortization $18,700

Note: Recreation was not a purpose to which joint costs were allocated. There were no costs for specific facilities. If recreation facilities had been included, these would have been charged as a specific recreation cost.

Table 6-43
Cost Allocation Report: Lake _____
Annual Benefits, Multipurpose Project

1. FLOOD CONTROL	$3,945,000
2. NAVIGATION	33,500
3. POWER	
a. At site	
Capacity: 16,400 x 19.29 x .955	$302,100
Energy: 162,279,000 x .00386 x .965	604,500
Less cost of transmission: 34,500 x 3.48 -	120,000
Net benefit at load center	786,500
b. Downstream	
Capacity	
Energy: 2,800,000 kwh at 2.5 mills	7,000
4. IRRIGATION	258,100
5. RECREATION	167,000
TOTAL	$5,197,100

Table 6-44
Cost Allocation Report: Lake _____
Determination of Separable and Joint Costs

Item	Construction Expenditures	Investment	Annual Charges				
			Operation and Maintenance	Interim Replacements		Interest and Amortization	
MULTIPLE-PURPOSE PROJECT					DOLLARS		
As Constructed	45,717,900	48,741,662	120,900	21,000		1,718,631	
Without Flood Control	42,491,500	45,301,869	111,000	20,600		1,597,343	
Without Irrigation	45,717,900	48,741,661	120,900	21,000		1,718,630	
Without Navigation	45,717,900	48,741,661	120,900	21,000		1,718,630	
Without Power	35,765,700	38,131,227	80,000	7,000		1,344,507	
SEPARABLE COST							
Flood Control	3,226,400	3,439,793	9,900	400		121,288	
Power	9,952,200	10,610,435	40,900	14,000		374,124	
Total Separable Costs	13,178,600	14,050,230	50,800	14,400		495,414	
RESIDUAL COSTS	32,539,300	34,691,432	70,100	6,600		1,223,217	

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

Table 6-45 Cost Allocation Report: Lake _____
Allocation by Separable-Cost-Remaining-Benefit Method[1]

Table 6-45
Cost Allocation Report: Lake _____
Allocation by Separable-Cost-Remaining-Benefit Method[1]

Item	Function							
	DOLLARS, unless otherwise noted							
	Flood Control		Irrigation		Navigation		Power	
1. Allocation of annual costs:								
a. Average annual benefits		3,945,000		256,100		33,500		793,500
b. Alternate costs		1,430,300						1,675,000
c. Limited benefits		933,965		161,508		20,963		602,197
d. Separable costs		1,430,300		258,100		33,500		793,500
e. Remaining benefits		26,487,946		4,580,487		594,526		17,078,757
(1) Amount		131,588						
(2) Percent of total		1,298,712		258,099		33,499		364,476
f. Allocated joint costs		66.44		13.20		1.71		18.65
g. Total allocation		26,487,946		4,580,487		594,526		16,873,735
2. Allocation of operation and maintenance costs:		863,633		171,633		22,276		242,373
a. Separable costs		995,221		171,634		22,277		671,397
b. Allocated joint costs		1,708,911		295,517		38,356		656,845
c. Total allocation		24,779,035		4,284,970		556,170		16,205,022
3. Allocation of major replacements:		9,900						40,900
a. Separable costs		46,572		9,255		1,201		13,070
b. Allocated joint costs		56,472		9,255		1,201		53,970
c. Total allocation		63.26		10.94		1.42		24.38
f. Construction expenditures in specific facilities								6,549,600
g. Total construction expenditures		400						14,000
a. Separable costs		24,779,035		4,284,970		556,170		16,097,777
b. Allocated joint costs		4,384		871		113		1,230
c. Total allocation		4,784		871		113		15,230

[1]Exclusive of non-allocable highway improvement costs, as noted in Table 7.

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

Table 6-46
Cost Allocation Report: Lake _____
Summary of Allocated Costs

Item	Flood Control	Irrigation	Power	Navigation
	Thousands of Dollars			
Construction expenditures:[1]				
Total allocation	$24,779.0	$4,285.0	$16,097.8	$556.1
Specific expenditures	0	0	6,549.6	0
Allocated joint-use expenditures	24,779.0	4,285.0	9,548.2	446.1
Percent of joint-use expenditures	63.3	10.9	24.4	1.4
Operation and ordinary maintenance:				
Total allocation	56.4	9.3	54.0	1.2
Specific costs	3.9	0	37.0	0
Allocated joint-use costs	52.5	9.3	17.0	1.2
Percent of cost of conventional joint-use facilities	65.6	11.6	21.3	1.5

[1]Exclusive of $500,000 highway improvement costs.

Table 6-47
Cost Allocation Report: Lake _____
Summary of Cost Allocation Findings

	CONSTRUCTION 1/	O&M 2/
Flood Damage Prevention	63.3	65.6
Power	24.4	21.3
Irrigation	10.9	11.6
Navigation	1.4	1.5

1/ Non-allocable highway relocation costs are not included, but costs in the amount of dollars are set aside as a highway improvement cost.

2/ Applicable also to replacements costs.

6-2**07**. Authority for Allocations of Costs. Referring to paragraph 6-2**06**, establish the authority, and any limitations of authority, for the allocation of costs to the various purposes. Where incidental purposes such as recreation are involved to which allocations of cost are to be considered, the authority for such allocations should also be established.

6-2**08**. Description of Project. Refer to drawings and briefly describe major features of the project such as type of construction, length, and height of dam and spillway structures; reservoir capacity; initial and ultimate power generating facilities; etc. Refer to Table 6-37 for additional information. Identify facilities which are used specifically for one project purpose, facilities which are used for several but not all project purposes, and facilities used for all project purposes. Identification should be referenced to the breakdown of costs into specific and joint-use classifications given on table entitled "Summary of Construction Expenditures" (Table 6-38).

6-2**09**. Construction Program. The planning and construction program for the multipurpose project should be outlined under this paragraph. Dates when planning and construction were initiated should be stated. Dates upon which the project became, or is scheduled to become, partially and fully available for each of the major purposes should be given and related to the in-service dates used in the cost allocation.

6-2**10**. Project Costs and Charges.

a. Construction Expenditures. Give estimate of construction expenditures for the multipurpose project, the value of items furnished without cost to the Federal Government, and amounts assigned for specific and joint-use features.

(1) Identify facilities provided in initial construction for future use and give estimated cost. Give bases for estimates. Refer to Table 6-38 "Summary of Construction Expenditures" for breakdown of costs.

(2) The following remarks pertain to the table "Summary of Construction Expenditures" (Table 6-38). This table should be prepared in such a manner as to clearly identify specific and joint-use costs, and to facilitate a comparison of the cost of similar items in the multiple purpose and alternative projects, both single purpose and multipurpose with each purpose omitted. Costs should be segregated in this table generally in accordance with the classification of permanent features as outlined in ER 37-2-10.

(a) Funds allocated for CP&E prior to authorization are not included in project costs if the funds are obligated prior to 1 October 1985. Funds allocated for CP&E obligated on or after 1 October 1985 and all advance engineering and design funds shall be made a part of the cost allocated to project purposes and of the cost apportionment between Federal and non-Federal shares, except where exempted by law.

(b) Costs for Engineering and Design and for Supervision and Administration will be distributed to the applicable project features.

(c) Costs will be recorded against sub-features necessary to identify the source of specific and joint-use costs.

(d) Care should be exercised in identifying specific and joint-use features because of the relationship between the breakdowns made for the cost allocation report and subsequent accounting of actual costs.

(e) Fish facilities should be segregated as between mitigation and specific enhancement facilities.

(f) Any specific recreation costs for lands or other items not under the recreation account should be identified.

(g) Wildlife enhancement lands should be shown as a separate line item.

(h) Costs not allocable to project purposes, such as certain highway improvement costs and certain costs related to cultural resources, should be identified and carried as separate line items.

b. Interest During Construction.

(1) Refer to tables on "Interest During Construction" and explain method by which interest during construction for the multipurpose project has been calculated. Interest during construction will be separately identified for the cost of specific facilities (Table 6-39) and the cost of joint-use facilities (Table 6-40).

(2) Computations will be based on scheduled construction expenditures (including value of items transferred), either actual or estimated. Interest will be computed from the middle of the month in which expenditures are incurred until the first of the month following the availability for service. Interest on any additional expenditures after the in-service date will be an operating expense.

(3) The various features and sub-features of a project will be considered in service progressively as they are completed and the project is available for serving the corresponding purposes. For this purpose, is not contemplated that features and sub-features related to a project purpose will be reported individually as sub-items but will be treated essentially as a unit, such as the specific flood control facilities being considered in service at the time the project is completed to the extent that it is available for flood control. The in-service date for a feature or sub-feature will be considered as the first of the month following the availability for service. In-service dates will be documented by memorandums to files or reported to higher authority as provided in other regulations.

(4) At the time the project is available for serving a particular purpose, the total cost of the joint-use facilities allocated to that purpose will be considered in-service, and interest during construction on those costs will be discontinued.

(5) For a multiunit power installation, each generating unit together with its proportionate share of joint-use facilities will be considered separately for purposes of computing interest during construction. Thus, when the first unit of a four unit power installation is available for service, interest during construction will be discontinued on one-fourth (assuming 4 identically sized power units) of the total cost of the specific power facilities, as well as interest on one-fourth of the total construction cost of joint-use facilities penstocks for future units and other provisions for future

power, and all joint-use costs allocated to power, will be considered in service with the initial installation scheduled as a part of a continuous construct schedule except in unusual circumstances. (In cases where power units are not identical in size, interest during construction on specific and joint-use power facilities, will be apportioned on the basis of name plate capacity of the generating units involved.)

c. Investment Cost. The total project investment cost consisting of construction expenditures, (including value of items transferred without cost to the Federal government) plus interest during construction, will be summarized. If the project includes non-allocable costs, this will be noted and total investment subject to allocation will be emphasized.

d. Annual Costs.

(1) Interest and Amortization. Interest rate and economic life which costs are amortized will be specified and the amount of annual interest and amortization costs will be cited. The basis for establishment of the project interest rate will be presented.

(2) Operation and Maintenance. Give estimates of total average annual cost for operation and maintenance of the multipurpose project and the amounts assigned to specific and joint-use classifications. Give basis for these estimates. Refer to table "Summary of Average Annual Operation and Maintenance Costs" for breakdown (Table 6-41). Costs for Operation and Ordinary Maintenance should be segregated in this table generally in accordance with the classification in ER 37-2-10.

(3) Major Replacements. A breakdown of major replacements in accordance with the Rehabilitation accounts is not normally necessary in cost allocation reports as the item is small and usually is estimated empirically. As with construction expenditures, the classification of specific and joint-use costs should be carefully prepared so that insofar as practicable the cost allocation report will be consistent with actual recorded costs. Amounts should be included in a separate line item in Table 6-41.

(4) Total Annual Costs. Cite amount and refer to appropriate tables showing specific and joint-use costs summary (Table 6-42).

6-2**11**. Project Benefits. Refer to **Paragraph 6-155 for reporting requirements for project benefits**. By separate subparagraph for each purpose, give amounts of estimated benefits and reference planning reports which explain bases of estimates. Any major deviation from planning reports must be explained.

6-2**12**. Alternative Projects.

a. General. Describe why estimates of alternative single purpose projects and of alternative projects with a purpose omitted are needed for the allocation study. By single or separate subparagraph describe briefly the alternative projects, costs, and investments. Refer to Tables 6-37, 6-38, 6-41, and 6-42 and drawings as appropriate. In regard to interest during construction for alternative projects, the computation of such on the basis of a year-by-year analysis of costs is often impractical. In such cases the reporting offices should furnish estimates of interest during

construction which they consider to be appropriate. If basic information on alternative projects or features is not of the scope indicated in the illustrative tables, in explanation should be furnished.

b. Alternative Single Purpose Projects.

(1) The most likely single purpose alternatives should in general be something other than a single purpose project constructed at the same general site as the multipurpose project (See paragraph 6-157). For example, the most economical single purpose alternative for power is likely to be a steam, nuclear, combustion turbine, or combined cycle plant. A likely alternative for water supply that would be developed in absence of the multipurpose project is a tributary site development or wells. An alternative project for recreation might be one or a number of smaller lakes at other nearby sites.

(2) The alternative costs used in the allocation process as a limitation on benefits should be determined on the basis of financing costs comparable to the Federal plan.

(3) The alternative used to limit benefits should be available at the same time as the multipurpose project, or where benefits are based on future need, at the time the alternative project would be required to satisfy the need. Discounting based on future use may be a factor if the entire project purpose is based on a future requirement, or if the requirement is for an increasing project output and construction of the alternative single purpose project would be staged by the non-Federal sponsor. An example of the matter would be adding wells to an alternative water supply project as the demand for water increased.

(4) In some cases, the development of detailed data on alternative single purpose plans may not be required; for example, where it can be conclusively established that costs would be greatly in excess of benefits and hence would not be a limitation on the amount allocated to the purpose.

c. Alternative Projects with a Purpose Omitted. Alternative projects with a purpose omitted should briefly describe significant differences from the multipurpose project as constructed to permit understanding of the separable costs determination. Reference should be made to appropriate tables. A derivative table (Table 6-44) showing separable costs of each function, for construction, investment, OM&R and total annual costs, should be presented.

6-2**13**. Discussion of Cost Allocation Method.

a. The cost allocation method will be briefly described, referring to steps of the allocation and the conversion of cost allocation results to cost accounting application in terms of specific facilities costs and allocated joint-use costs. Reference should be made to the cost allocation table (Table 6-45).

b. If costs included in the allocation cover both initial and future costs, results in Table 6-45 will include subheadings (1) and (2) under table line item 5g to show breakdown between initial construction cost and additional future costs (present worth value if appropriate) respectively. It may be desirable to present a summary tabulation (Table 6-47), particularly if the cost allocation has included both initial and future costs. In such cases, Table 6-46 would be limited to initial costs, providing a better understanding of results for cost accounting use.

c. Proper understanding of the cost allocation requires inclusion of data as presented in Table 6-37 through 6-46. The data should generally be presented in the format shown to provide understanding of the relations between the multipurpose project and alternative projects as to pertinent data, costs, and benefits. Additional tables as required should be included on computation of interest during construction (IDC) for all purposes with specific facilities.

d. The procedures for computation as illustrated in the tables required that an approximate determination be made of percentages for allocating joint-use construction costs in order to derive project investment. Interest during construction is partially dependent on the allocation, yet the estimated investment is required before the cost allocation can be made. The approximation can be made using construction expenditures instead of investment, or by approximating percentage for placing plant in service in computing interest during construction on joint-use costs. Where the approximate percentages do not differ more than one-half of one percent from the final percentages determined for allocating construction cost, no further adjustment is necessary. Where the deviation is greater than one-half of one percent, a subsequent refinement shall be made in the computations. It is not necessary to include the trial allocation in the report. However, the table showing interest during construction on joint-use facilities should state the trial percentages used in placing purposes in service, and other data as required for understanding the computation of interest during construction (reference footnotes on Table 6-40).

6-2**14**. Summary of Cost Allocation Findings.

a. The final paragraphs of the text should present the percentages for cost accounting use, including those for joint-use construction costs and for O&M costs rounded to the nearest one-tenth of one percent. It should be specified that percentages for operation and maintenance are also applicable to replacement costs.

b. Appropriate reference should be made to separable recreation costs relative to specific costs. If they differ, information must be presented to permit accounting identification of separable costs consistent with the cost allocation findings. Identification will be by designation of sub-features or proportionate part, as may be appropriate. The summary findings should also make reference to any non-allocable costs. If final amounts are known at the time of the allocation study, these should be cited. Otherwise, information should be provided as to how final determination will be made, with reference to a percentage of appropriate feature or sub-feature costs.

c. The summary, with reference to the project cost allocation, should be presented as in Tables 6-45 and 6-46. For application to financial records, the percentages for allocations of joint-use costs are summarized as in Table 6-47.

6-2**15**. Reserved.

SECTION XVI - INTEREST RATES

6-2**16**. Purpose. This section prescribes the applicability of interest rates to be used during plan formulation, evaluation, cost allocation, and reimbursement studies.

6-2**17**. Interest Rate Change. HQUSACE will advise FOA of the current interest rates to be used each fiscal year in formulation and evaluating Federal water resource plans and projects, and in determining of project costs.

6-2**18**. Feasibility Studies. Feasibility reports submitted to the division commander after 31 December shall contain benefits and costs reflecting the current fiscal year interest rates. Project formulation studies need not be adjusted because of the change in interest rate unless it would impact on the report recommendations.

6-2**19**. Continuing Authority Projects Not Specifically Authorized by Congress. Detailed Project Reports submitted to HQUSACE after 31 December shall contain benefits and costs reflecting the current fiscal year interest rate.

6-2**20**. Authorized Projects.

a. Authorized projects which have received an appropriation of construction funds may continue to use the interest rates that were used to prepare the supporting economic data presented to Congress in justification of the initial appropriation of construction funds, in making any subsequent evaluations, cost allocation studies, and cost sharing determinations **during the initial construction period**. For the purpose of this regulation, appropriation of construction funds includes funds for "Land Acquisition Only." Additionally, **supporting economic data presented to Congress and economic evaluations during the construction period** should also be displayed at the current interest rate.

b. General or Economic Reevaluation Reports and budget justification data for projects authorized prior to 3 January 1969, which have not received a construction appropriation, may derive benefits, costs, benefits-cost ratio, and cost allocations based on an interest rate of 3-l/4 percent, provided that satisfactory assurances of local cooperation were received for these projects prior to 31 December l969. The 3-1/4 percent rate will apply to active projects authorized prior to 3 January 1969, where there is no requirement for local cooperation. Additionally, all evaluations should also be displayed at the current interest rate.

c. For projects not covered by a or b above, the current interest rate shall be used in evaluation, cost allocation, and testimony to Congress.

d. In the case of projects which at one time qualified for use of 3-1/4 percent interest rate as provided in b above, but for which the non-Federal sponsor subsequently withdrew the support of and commitment to the project, the 3-1/4 percent shall no longer be applicable, even though the non-Federal sponsor may again provide the necessary assurances at a later date. An interest rate shall be determined based on either a above, if applicable, or the current rate. If the non-Federal sponsor has not withdrawn support, but is unable temporarily to fulfill the financial commitment, the rate stipulated by b above shall apply. For projects reclassified to the inactive category due to lack of such support and later reactivated, c above shall apply.

6-2**21**. Reimbursement. Establishing the present worth of project investment cost to be reimbursed by non-Federal sponsors requires that interest during construction be charged. If reimbursement is to occur over time an interest rate is also used in establishing the repayment schedule. The interest rate used in these two calculations will vary one from another, and each will, in general, vary from the interest rate used in project evaluation and cost allocation studies, as explained below.

a. Except as noted below, whenever a non-Federal sponsor is required or elects to repay project implementation costs over a period of time, the amount paid over time shall include interest based on the yields of US Government securities with periods left to maturity comparable to the repayment period.

b. Except as noted below, the project investment cost for non-federal interest cost share, or project purpose repayment contract purposes (e. g. water supply), shall include interest during construction using rates based on the yields of Government securities with periods left to maturity comparable to the construction period. Since allocated costs, if any, will have been based on the formulation and evaluation interest rate, these costs must be modified to account for interest during construction using the above interest rate.

c. The above rates will be determined annually, as of the month preceding the fiscal year in which costs for the construction of the project are first incurred (or in the case of recalculation, the fiscal year in which the recalculation is made. The rates are determined by the Secretary of the Treasury.

d. Irrigation reimbursement shall be computed in accordance with Federal Reclamation Law.

e. Studies for additions or changes in project purposes subsequent to initial construction shall be at the current applicable interest rate(s).

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1. **[Policy Guidance Letter No. 25, Federal Participation in Land Development at Structural Flood Damage Reduction Projects, 16 October 1990, provides additional guidance on land development in flood damage reduction projects. Under the policy for implementing Executive Order 11988, it is Corps policy to avoid direct or indirect support of development in the base floodplain wherever there is a practicable alternative. The following general policy principles apply to the consideration of land development benefits at structural flood damage reduction projects.**

(a.) Projects or separable increments of projects that achieve only land development (benefits) will not be recommended.

(b.) NED plan will be formulated to protect existing development and vacant property that is interspersed with existing development. All project benefits, including land development benefits for the interspersed vacant property, will be included for project formulation and justification. The NED plan may also provide for the protection of vacant property that is not interspersed with existing development if it can be demonstrated that the vacant property would be developed without the project and benefits are based on savings in future flood proofing costs.

(c.) If no project or separable increment can be economically justified to protect existing development, interspersed vacant property and/or property that would be developed without a project; there is no budgetary interest in expanding the area of protection to achieve land development (location) benefits even if economic justification can be achieved.]

2. **[Policy Guidance Letter #41 precludes the use of the restoration of land value benefit category due to difficulties in estimating actual market effects. No resources are to be expended to quantify benefits for restoration of market values for flood control projects.]**